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MARCH 1947

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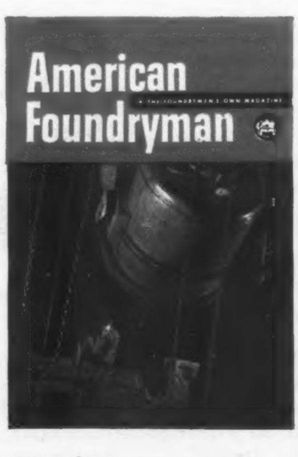

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This Month's Cover

Shows use of a million-volt X-Ray unit in search for possible defects in large steel casting. Knowledge thus gained leads to better control in foundry production.

(Photo courtesy General Electric X-Ray Co., Chicago)

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★ MARCH WHO'S WHO ★

F. T. Chesnut

See herein: *Induction Melting*. . . . Author, Frank T. Chesnut, was born in Washington, D. C. . . . Received his Bachelor of Science degree in electrical engineering (1924) from University of Maryland, College Park. . . .Took advanced work at both Princeton University, Princeton, N. J., (1926) and University of Maryland (1935) . . . . Held various positions while working during summer vacation periods including that of mechanic with Potomac Electric Power Co., Washington, D. C., and electrical mechanic, Shawinigan Engineering Co., Montreal, Canada. . . . Was affiliated with General Electric Co., Schenectady, N. Y., in the general engineering laboratory, 1924-26. . . . For one year was connected with Gibbs & Hill Co., New York. . . . During 1927-28 was assistant jobbing engineer, Jas. Stewart Construction Co., New York. . . . Joined Ajax Electrothermic Corp., Trenton, N.J., in 1928 as assistant to Dr. E. F. Northrup. . . . Held the following positions with this firm: electrical engineer, patent attorney, secretary and treasurer. . . . Has written widely for the trade press since 1930 and has contributed much in the way of knowledge to technical societies. . . . Nature of subjects has been development, application and research of high frequency electric induction furnace. . . . Served as a member of U. S. Naval Technical Mission to Japan, Magnetic Group. . . . Member, American Institute of Electrical Engineers.

M. E. Gantz

Twenty-eight year old Marvin E. Gantz was born in Denver, Colo. . . . Was graduated from the Colorado School of Mines, Golden, with a Bachelor of Science degree in metallurgical engineering (1940) . . . Was named metallurgist, American Magnesium Corp., Cleveland, following his graduation . . . In 1946 appointed assistant superintendent . . . Has written for meetings of technical societies on recommended coreroom and foundry practices in magnesium alloy foundries . . . Contributed to A.F.A. TRANSACTIONS in 1943 *Magnesium Foundry Sand Practices* . . . Has in this issue a treatise on *Aluminum Alloys, Small Calcium Additions* . . . A member of American Society for Metals.

E. A. Carsey

Born in Cincinnati, Ohio . . . Attended University of Cincinnati and Ohio Mechanics Institute . . . Began his long association with The Kirk & Blum Mfg. Co., Cincinnati, Ohio, in 1925 as blue print boy and is at the present time assistant chief engineer . . . Has written for the trade press and meetings of technical societies on dust control, pneumatic conveying, fume removal, etc. . . . Herein, see: *Foundry Dust Control Systems, Hoods and Piping* . . . Holds membership in American Society of Heating and Ventilating Engineers and is also a member of The Engineers Club of Dayton.

P. M. Sanders

Paying homage to the contestants of the 1946 Apprentice Contest, castings division, P. M. Sanders comments on the casting technique of each division winner . . . See in this issue: *Apprentice Contest Results* . . . The author was born in the nickel country, Sudbury, Ontario, Canada. . . . Attended both Wayne University, Detroit, and University of Michigan, Ann Arbor. . . . From 1934-40 was assistant superintendent, Electric Motors, Inc., Detroit. . . . Associating with Ford Motor Co., Dearborn, Mich., he was metallurgical engineer, 1940-45. . . . At present is consultant in metallurgy, Detroit. . . . Has written for the trade press in relation to cast Jominy bars. . . . Member of the A. F. A. Educational Division, Subcommittee on Apprentice Contest. . . . A member of A. F. A., he is also active in the American Society for Metals.

K. M. Smith

Kenneth M. Smith contributes to this issue *Foundry Dust Control Systems, Maintenance* . . . Born in Rockford, Ill. . . Obtained his Bachelor of Science degree in mechanical engineering (1939) from the University of Illinois, Urbana . . . Upon graduation became connected with Caterpillar Tractor Co., Peoria, Ill., as staff engineer, plant engineering department and maintained that position until 1943 . . . In 1944 was appointed foundry engineer . . . Has prepared talks on foundry dust control for meetings of technical societies . . . A member of ASME, ASM and A.F.A.

J. R. Adams

A native of the Badger state, city of Milwaukee . . . He has taken an Emerson Efficiency Course and extension courses from Pennsylvania State College, State College, Pa., concerning mechanical engineering and related subjects . . . Began his industrial career as molder apprentice, National Brake & Electric, Milwaukee, and later became coremaker and molder with that firm during his 1904-11 affiliation . . . From 1912-13 was salesman for Thompson's Malleable Foundry Co., Waukesha . . . Became coreroom foreman, Zimmerman Steel Co., Bettendorf, Iowa, for three years (1916-19) . . . Was connected for a short time with Electric Steel Co., Chicago, as coreroom foreman . . . Associated with Lebanon Steel Foundry,

Lebanon, Pa., for 18 years, he left that concern in 1938 as general superintendent after advancing through the coreroom, cleaning and finishing departments . . . From 1938 to the present time has been connected with Crucible Steel Casting Co., Lansdowne, Pa., and now holds the position of vice-president in charge of operations . . . Has written for the trade press and his paper *Producing Steel Castings Without Venting Molds* was presented before the recent A.F.A. Wisconsin chapter regional conference in Milwaukee. . . . A member of A.F.A. and Steel Founders Society of America.

J. W. Juppenlatz

In this issue: *Quality Control* . . . Born in Springfield, Mass. . . . Attended Massachusetts Institute of Technology, Cambridge, Mass., for one year and has taken metallurgical courses during the summer sessions . . . Started his business career in 1921 with the Chapman Valve Mfg. Co., Springfield, Mass., as chief metallurgist . . . Began a three-year association with Midvale Co., Philadelphia, in 1929 . . . One year later (1933) became connected with New Jersey Silica Sand Co., Millville, N. J., as a sand engineer . . . Became associated with Link Belt Co., Philadelphia, in 1934 as metallurgist . . . Was appointed chief metallurgist, Treadwell Engineering Co., Easton, Pa., in 1935 . . . At present is chief metallurgist, Lebanon Steel Foundry, Lebanon, Pa., and has been with this firm since 1942 . . . Has written quite extensively for the trade press and has been a frequent speaker before various technical societies . . . An A.F.A. Steel Division member and associated with the Committee on Non-Destructive Testing . . . Holds memberships in AIME, ASM, ASTM, SAE, Steel Founders Society and A.F.A.

51st A.F.A.

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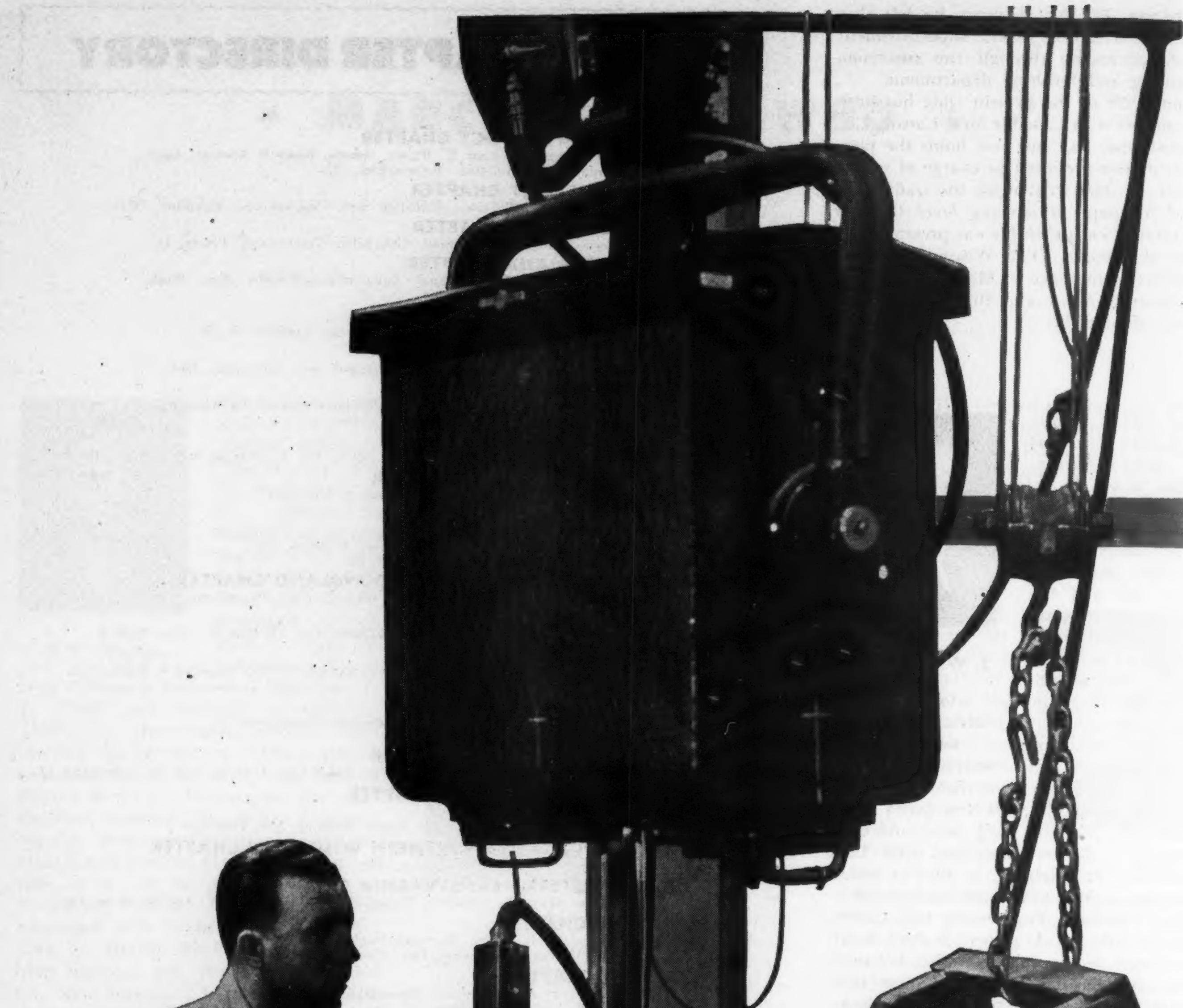


PROGRAM WILL STRESS NEW TECHNIQUES

In their broad-scope presentations of recent work and progress, their discussions of current problems, post-war perplexities, new developments and researches, new methods and techniques, the technical and general interest sessions of the Association's 51st annual convention will constitute a castings industry forum of maximum interest and immediate and lasting value to every foundryman of North America and the world.

Arranged by the Association's eight divisions and nine general interest groups, the program will mark, by its diversity, the breadth of the science of metal casting and the widely varied interests of the men of the foundry field. And, with the program sub-divided, sessions will be grouped so conveniently that all related and cross interests will be served. Each A.F.A. member and guest, then, will have full opportunity to participate in a discussion of his specialities, be he manager, technician, shop man or educator.

The papers to be presented were selected and invited by the Association's technical divisions and other groups with a view to today's and tomorrow's problems, and the varied interests of the entire industry. To insure a high standard of quality, all papers to be presented have been carefully reviewed by the program and papers committee of each division. And to encourage the fullest possible discussion of every subject presented, the number of scheduled papers has been definitely limited, and preprints of practically all technical papers will be made available to the membership at least thirty days prior to the convention.

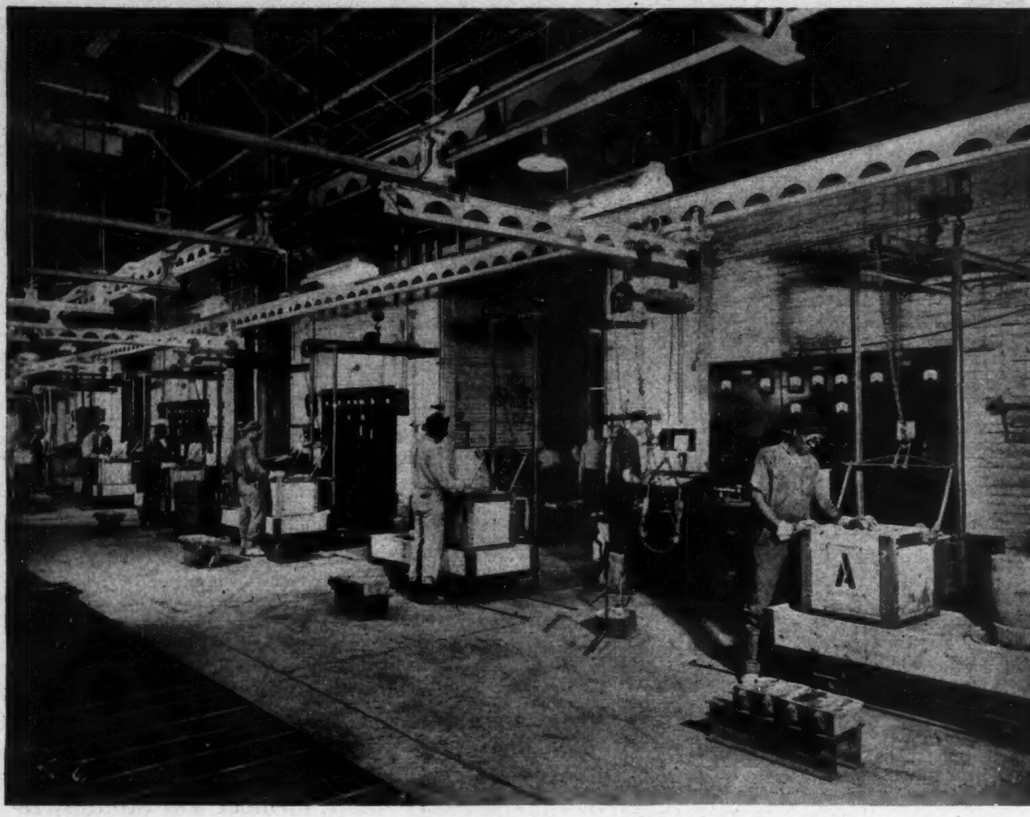
Presentation, plus full discussion, of subjects of a technical and practical character are the backbone of all A.F.A. meetings. Constructive, all-viewpoint discussion supplements formal presentation. It is hoped, therefore, that every A.F.A. member will carefully review, in preprint form, the technical papers of the coming convention and either submit a written discussion or come to the meeting prepared to discuss the topics which lie within his field of interest. By participating in the discussion each member will make a welcome contribution to efforts to make A.F.A. conventions as broad as possible in scope and purpose.

There has been great progress in the art-and-science of metal casting in recent years. There remain, however, a multitude of directions for greater progress. The technical sessions of the 51st convention—many of which will disclose hitherto completely veiled war-born secrets—were conceived to broaden the base of recent advances and to point out directions in which progress can be accelerated and new growth made. They will mark, as all A.F.A. annual convention sessions have marked, the real milestones of a rapidly advancing industry.

S. C. Massari

S. C. Massari, *Technical Director*
American Foundrymen's Association

S. C. Massari, Technical Director, American Foundrymen's Association, in charge of all its technical activities, was formerly chief metallurgist, in charge of research, Association of Manufacturers of Chilled Car Wheels. During the war he served with the Ordnance Department, Army Service Forces, in charge of Tank Automotive Production in the Chicago Ordnance District, with rank of colonel.



High frequency lift coil furnaces used for making bronze precision castings.

INDUCTION MELTING FURNACES

Frank T. Chesnut
Secretary
Ajax Electrothermic Corp.
Trenton, N. J.

Several types of induction furnace have been used by industry; but only two, the submerged resistor or low frequency furnace, and the coreless induction or high frequency furnace, have been continuously successful.

The first successful induction furnace to make its appearance in the commercial field was the submerged resistor furnace. Although experiments leading up to it were begun about 1910, a successful unit was not on the market until 1916. The principle of the submerged resistor furnace is basically the same as that of the older ring type induction furnace except that the electromagnetic pinch effect forces are turned to advantage and, with the motor effect, are used to stir or circulate the metal.

This stirring effect, found also in the high frequency and in certain salt-bath heat-treating furnaces, is probably the greatest asset of the electric induction furnace.

A submerged resistor furnace comprises a melting hearth with a depending loop. A transformer winding and core thread the loop and cause molten metal in the loop to become heated and circulated into the metal bath in the hearth above. The furnace is powered from a normal frequency supply of alternating current.

A variation of the older submerged resistor type is especially adapted for the melting of aluminum and its alloys. A special design permits the melting of these alloys without the clogging of the melting channels by impurities and oxides in the melt. Such obstructions as do form are more easily cleaned from the melting channels; and deposits which collect in the lower channel may be removed during a shutdown for repairs.

A high frequency furnace was projected about the time that the submerged resistor furnace was making its debut, and laboratory type equipments appeared on the market about the years 1917-18.

The principle of the high frequency furnace is that of an air-cored transformer. The primary is a helical coil which surrounds the charge to be heated, while the secondary is the charge proper. Thus for the high frequency furnace, the hearth may be of simple construction without the need for loops or special forms. Since an iron core is relatively useless for high concentration of flux, it is seldom used on high frequency melting furnaces. Because of this, the furnace is sometimes called the coreless induction furnace.

The high frequency or coreless induction furnace is unique in industry. It has almost all the qualities for making alloys that the submerged resistor furnace has and, in addition, has many other desirable characteristics. The high frequency furnace is used for both ferrous

M. lting silver in a high frequency fu nace. Because of negligible loss, th s furnace is a desirable unit for th melting of precious metals.

and nonferrous metal melting as well as for numerous heat-treating or specialty applications.

It may be confusing, to the average metal melter or foundryman, which of the aforementioned furnaces should be selected for a given job; or whether an induction furnace of any kind should be considered. Looking at the problem broadly, it will be noted that certain advantages are inherent with induction melting furnaces.

1. Principal among these is the fact that the same force which melts the metal also stirs it effectively, insuring alloys of homogeneous analysis.

2. In an induction furnace, all of the heat energy is induced into the charge proper and the only heat which escapes is that due to I^2R loss in the furnace windings, the heat which is conducted outwardly through the refractories of the furnace wall, and that which is radiated from the surface of the bath. Since the surface of the bath usually is of small area, little heat is lost there.

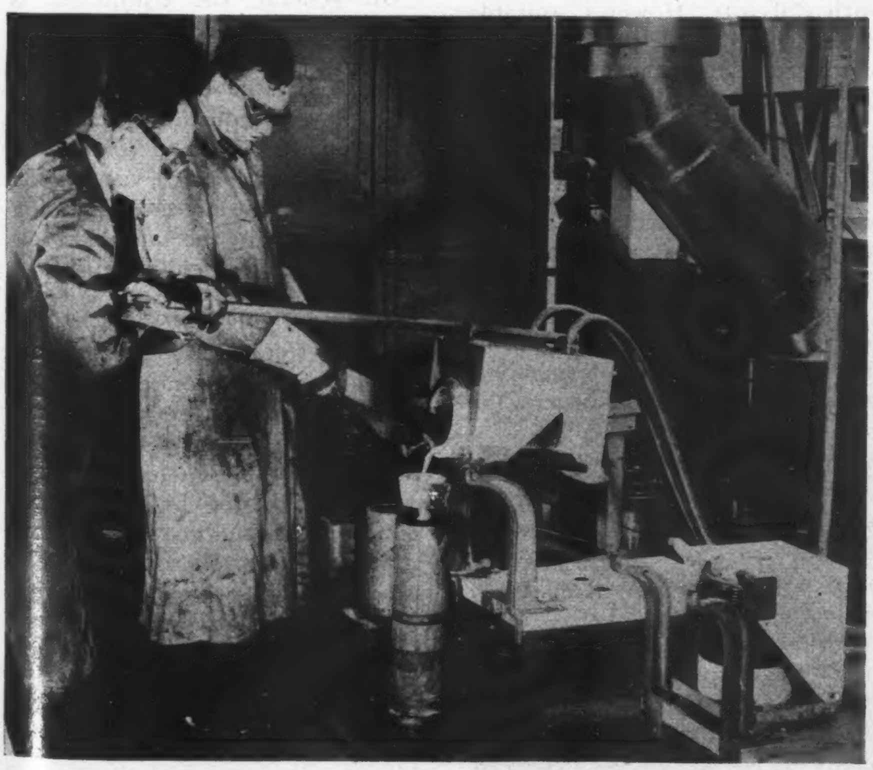
Usually, there are no fumes or waste products of combustion with induction furnaces, and this, with the fact that the furnaces run cool on the outside, makes for better working conditions for the operators. While this point cannot be evaluated easily in dollars and cents before an installation is made, it shows up in the over-all picture. More operator attention, plus the inherent characteristic of the furnaces to produce good metal, means fewer rejections.

3. The melting losses in the induction furnace are more predictable and lower than for other types of furnaces. Measured in zinc loss for brass melts, the loss rarely exceeds 0.5 per cent, and in remelting stainless scrap the chromium loss is almost negligible. This is due to the fact that metal is not exposed to air over large areas; there are no arcs or hot spots to overheat parts of the charge, and melting time may be less.

Submerged resistor furnaces are made in several sizes. Two series of this type of furnace run in size from 60 to 150 kw, with a pouring capacity of about 800 lb, and from 175 to 300 kw, with a pouring capacity of about 2000 lb. Aluminum melting furnaces are made in 60, 125, 250 and 500 kw sizes, with pouring capacities of 200, 1250, 2500 and 5000 lb, respectively; and in a 20-kw, 600-lb holding furnace for ladle operation.

These furnaces operate from normal frequency supply lines and are controlled with voltage-regulating transformers and contactors. The uncorrected power factor is from 60 to 70 per cent for the brass melting furnaces, and from 27 to 70 per cent for the aluminum melting furnaces. The power factor may be corrected, as economy dictates, by adding static capacitors.

Efficiency of the brass furnaces runs around 80 per cent for a 24-hr day, and around 60 per cent for an 8-hr day. The aluminum melting furnaces have a somewhat lower



Development work on many modern alloys was done with high frequency furnaces, as shown at left.

High frequency furnace used for centrifugal and precision castings.

efficiency (about 70 per cent and 50 per cent, respectively) because, compared with brass, more energy is required and the larger bulk per pound increases the conduction and radiation losses.

Production from submerged resistor furnaces is about 4 to 6 lb of red brass, 7 to 11 lb of yellow brass and 3½ to 5 lb of aluminum per kwhr, the lower figure in each case being for an 8-hr day with a 16-hr holdover period, and the higher figure for 24-hr day operation.

The holdover requirement, while advantageous in some respects, is one of the most serious disadvantages of the submerged resistor furnace. The furnace is started by preheating the lining, then preferably pouring in molten metal. The shape and inaccessibility of the melting channel renders it vulnerable to thermal shock, and to obtain long life it is essential that the furnace be emptied and restarted infrequently as possible.

For this reason, a heel of molten metal is maintained in the melting loop and lower hearth over long nonoperating periods. While the character of the electrical load is good and while the power required to maintain a molten heel is low, nevertheless it affects the over-all efficiency rather seriously for 8-hr day operating schedules. An advantage of maintaining a heel is that the furnace is ready for work at the beginning of the work-day.

The requirement for a holdover charge rules against changes of analysis of the metal being melted, and these furnaces, therefore, are best suited for continuous runs on metal of a constant analysis. It is because of this feature that the high frequency induction furnace often is more desirable for general foundry work.

Lining performance in the submerged resistor furnace usually is satisfactory. A lining for yellow brass may last for from one to ten million pounds of metal—two million is average. A lining for red brass should last, on the average, for half a million pounds. Lining failures are due in general to the attack of the oxides of copper and lead rather than to temperatures of the metals being melted.

Nickel silver (65 Cu, 18 Ni, 17 Zn) requires a relatively high pouring temperature and, although lining materials are not a problem, the lining life is somewhat less than for the yellow or semi-yellow metals. Similarly, there is no lining problem for the cupro-nickel alloys (70 Cu, 30 Ni, and 75 Cu, 25 Ni) and, with a lining life of about a quarter of a million pounds, the submerged resistor furnace is almost exclusively preferred for these alloys.

Low Zinc Alloys

Linings for use with alloys low in zinc were, in the past, somewhat of a problem; and the 85-5-5-5 brass, and red brass mixtures high in copper and lead were handled with difficulty. However, suitable linings have been developed and more of these metals are melted in the submerged resistor furnace.

Linings for the aluminum melting furnaces last for from one to three million pounds or more of metal, with a conservative average of a million and a half pounds.

For sand castings, the submerged resistor furnace may be considered where large quantities of yellow or semi-yellow brass or manganese bronze are used; also, where the copper in the completed alloy is not over 83 per cent with a maximum of about 5 per cent lead, some tin, and the remainder zinc; and where the quantity of a single alloy is around 20,000 lb per week, or perhaps 15,000 lb if good working conditions and quality of product are a consideration.

Phosphor bronze, manganese bronze, high-zinc alloys, aluminum alloys, oxygen-free copper and the like, in addition to the metals already listed, make good charges for the submerged resistor furnace. Magnesium, the precious metals, low-temperature alloys and steel are typical of the metals which are not well suited for these furnaces.

High Frequency Equipment

A high frequency furnace combines substantially all the qualities of the submerged resistor furnace, and has additional advantages which, except for its first cost and slightly lower efficiency, are of sufficient importance in industry to make it an excellent furnace for metal melting.

It will melt all the metals listed for the submerged resistor furnace, and almost all other metals. The furnaces are more flexible as to size and control, and a single furnace can be used for a wide variety of melting operations by changing crucibles or the furnace lining.

The part of the equipment which makes a high frequency furnace installation more expensive, and incidentally less efficient than other electrical furnaces, is the requirement for some means of producing the high frequency current. With the smaller equipments, static converters are used; but with the larger furnaces, motor generators must be used.

In general, the equipment is more expensive than submerged resistor furnaces by the cost of the motor generator set, some additional control equipment and a larger bank of capacitors to correct the inherently lower power factor. The efficiency of the melting operation usually is less by the amount of loss in the generating equipment.

Furnace Sizes

High frequency furnaces are available in sizes from a fraction of a pound to half a ton for the brass and nonferrous metals, and to 8 and 10 tons for steel melting. When purchasing high frequency equipment, one buys much more than the furnace proper, namely, a power source which is applicable to many different sizes of furnaces for melting operations, heating for forging, hardening, etc.

The electrical equipment is relatively higher in cost than for the

submerged resistor furnaces while the furnaces are relatively much lower in price. For this reason, it is common to install several furnaces for different operations powered from the single generator.

A general melting efficiency of 60 per cent may be assumed for the high frequency furnaces. This is lower than for the submerged resistor furnaces, by 20 per cent in the case of the brass melting furnaces, and 10 per cent in the case of the aluminum melting furnaces, considered on a 24-hr day basis.

It is at least comparable with the submerged resistor furnace efficiency for brass melting, and 10 per cent better than for aluminum melting, when figured on an 8-hr day basis. The reason is, of course, that the high frequency furnace is poured clean and no molten heel is maintained over periods when the furnace is not operating.

Melting Rates

The high frequency furnace will melt red brass at the rate of about 5 lb per kwhr, as compared to 6 lb per kwhr for the submerged resistor furnace and on a 24-hr day basis. On an 8-hr day basis the margin is in favor of the high frequency furnace by a pound or so per kwhr. The high frequency furnace will melt yellow brass at the rate of about 6 lb per kwhr, aluminum at about 3½ lb per kwhr, and other metals at comparable melting rates.

It also will melt magnesium, the precious metals, steel, nickel and the ferrous alloys, which are not good charges for the submerged resistor type furnace. Steel is melted in the high frequency furnace at the rate of better than 3 lb per kwhr.

A feature of the high frequency furnace, not found in other types, is that it may be used as a ladle. After melting is completed the furnace shell may be lifted with a crane and moved with its charge to a distant pouring station. This is a distinct advantage for the larger furnace units, as ladle preheating may cost as much as 50 cents to a dollar or two per ton of metal handled in the ladle.

The high frequency furnace is particularly suitable for centrifugal and precision casting work because charges of any convenient size—from a few ounces to many tons—can be melted and poured under extremely close control of analysis and temperature; and the method of melting can be adapted to work separately or integrally with the many types of casting machines.

One type of high frequency furnace which has found wide favor in the smaller brass foundry is the lift coil furnace. In this furnace, the metal is melted in a free-standing clay-graphite crucible. The crucible is picked up in a shank and carried to a pouring station.

A ladle is not required, and mixtures can be changed as often as desired without danger of contamination. Although the over-all efficiency is not as high as for the built-in type of crucible (about 15-20 per cent lower), the extreme flexibility and control make this furnace useful where several alloys must be handled regularly.

Vacuum furnaces, once available only in small laboratory sizes, are now available in sizes to several hundred pounds of steel capacity, and are arranged for melting and pouring under vacuum conditions.

Refractory problems with the high frequency furnace are so diverse and varied that they cannot be briefly compared with those of the submerged resistor furnace. Crucibles for red brass last for 40 to 70 heats, and considerably longer for the yellow metal. Steel melting linings last about 16 to 600 heats, depending upon the type of steel, the operation, and the skill of the operator in maintenance.

Magnesium Melting

This paper would not be complete without the suggestion that the high frequency furnace probably may be used for magnesium melting. Although it is used for this purpose where the furnaces already are installed, and is used for larger commercial melting in England, it still is not used extensively in this country.

If the magnesium metal is relatively free from oxidation, and gas covers can be used instead of the common fluxes, then the submerged resistor furnace might also be suitable for some magnesium melting applications.

In summarizing, it may be said that the use of an electric induction furnace is justified where the metal to be melted is of a critical analysis, where its quality must be kept high or where flexibility and working conditions are important considerations; and that the furnace to be used should be determined by the economics of a particular set of conditions, including the stand-by charge for power, the kind and volume of metal to be melted, the length of the working day, and the life of the refractories involved in the operation.

A flexible arrangement of melting furnaces for purposes of laboratory and specialized production work.

PRODUCING STEEL CASTINGS WITHOUT VENTING MOLDS

An interesting viewpoint on venting is set forth in this paper, presented at the 10th Annual Regional Foundry Conference of the Wisconsin Chapter, A.F.A., at Milwaukee, Feb. 13-14, 1947.

J. Richard Adams
Vice-President
Crucible Steel Casting Co.
Lansdowne, Pa.

Venting of the molds into which molten steel is poured is a practice dating from the earliest production of steel castings. Seeking to determine whether the practice has a supporting, scientific basis and is necessary to the production of sound castings, a number of foundries have studied the mechanics of such venting. Recent investigations indicate that venting of mold cavities serves no worthwhile purpose, and suggest that steel foundrymen should re-examine their tradition-fixed ideas on the subject.

In the early twenties many steel foundries vented molds excessively. Concurrently, the necessity of maintaining high permeability in both facing and backing (heap) sands was advocated. It was inferred that free escape of mold gases through permeable sands would relieve mold cavity pressure during pouring, guard against re-entry of those gases into the steel and result, on solidification, in nonporous (pinhole-free) castings. In an effort to maintain permeability at about 200 A.F.A. and over, many steel foundries changed to coarse sand; others experimented with equal, and unequal, amounts of fine and coarse mixtures, or introduced gravel of various sizes into the sand.

With greater knowledge of chemical reactions in the bath, steelmakers today consider proper equilibrium of molten steel and slag to be more effective than sand permeability in prevention of pinholes. Excessive moisture in green sand molds has also proved to be of minor importance as a factor in porosity.

Fire clays containing chemically combined moisture were employed in the earliest casting of steel. A workable mixture with refractory qualities resulted, and the molds were baked or thoroughly dried before pouring. In time, however, it was considered possible to pour such molds without pre-baking or drying. Although the earliest experiments were not wholly successful, out of them developed the so-called "green sand practice" employed in the production of most small steel castings.

Mold venting, it appears, is an outgrowth of the use of fire clays, and of molding sands of low permeability. The practice could have been eliminated, however, as bentonite-type clays replaced fire clays, since the former tend to increase permeability owing to the fact that they expand when mixed with sand and water. Immediately following the introduction of bentonite clays as a binding ingredient in steel molding, green sand casting of steel became widespread.

Many steel foundrymen hold to

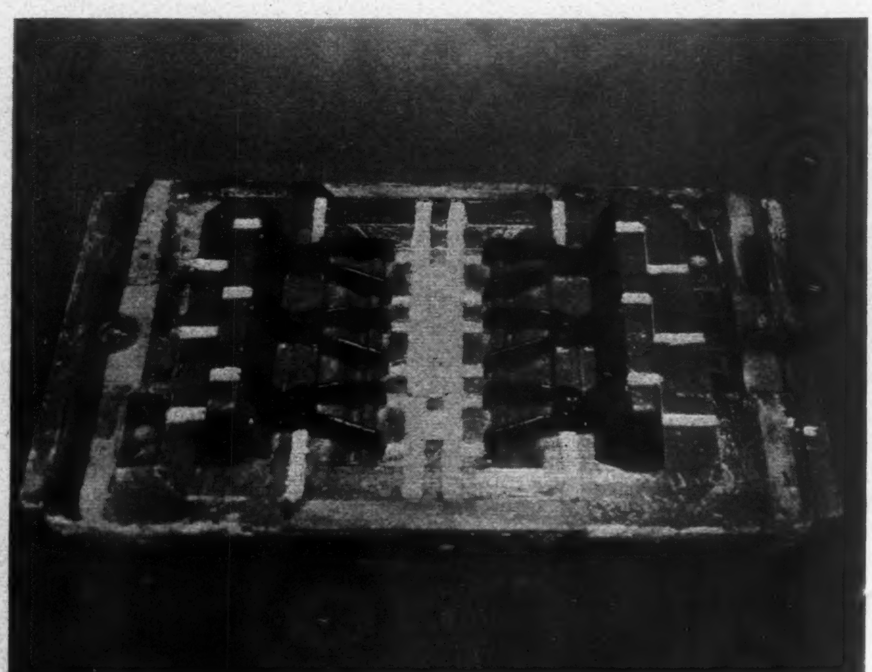
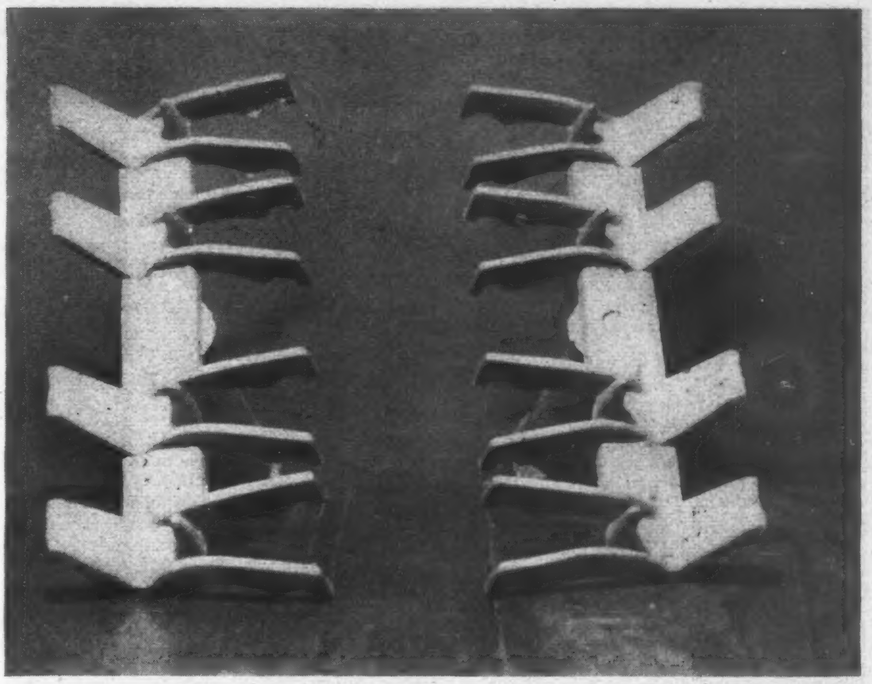


Fig. 1—Pattern equipment for brick cutting wire holders as received from another foundry. Three castings on gate, two pours in mold. Note elaborate venting system provided with inverted leather fillets.

Fig. 3—Four castings on gate, two pours in mold. Pattern equipment consists of cast metal plate, same size flask required, drag view shown. Note the two projections on ends of castings which are cast upward in the cope. No vents used.



the theory that molds must be vented up through the cope to let air out. They reason that unless the pressure, presumably built up and progressively increased during pouring, is relieved, it will become so great as to arrest the inflow of metal before the mold cavity is filled, causing premature solidification. They point out that, unless vents are taken off up through the cope, they are unable to run light-sectioned castings or to fill out other castings sharply in the higher points.

On the other hand, light-sectioned castings weighing little more than one ounce each, with as many as twenty to a gate, are being run successfully without such venting. Others with $\frac{3}{16}$-in. sections and extremely great surface areas, made on jolt-squeeze machines in slip flasks, are regularly cast with no appreciable increase in misruns.

Molds properly poured with metal hot enough to run work of this character, and so gated as to keep liquid metal actively moving, are not influenced by any provision of additional mechanical venting. Nor is additional mechanical venting necessary to insure the running of the castings, or to allow any mold cavity to run full and sharp at any point, provided the permeability of the sand is over 40 A.F.A.

It is the writer's conclusion that many so-called "strain gates" (which do not function as such to eliminate swells), "flow-offs" and "popsticks" could be eliminated, since they serve only as vents and fill with metal which must be removed by acetylene torch in processing. Frequently, voids, blows, trapped air and dirt are found under such vents; and all such defects must be chipped out for the repair weld.

Whether or not mold venting is important to non-ferrous casting is not known. It is likely, however, that too much emphasis is placed on any supposed advantages of the practice, particularly when sand permeability is above 40.

Some years ago a foundry with which the writer was connected experienced considerable difficulty in producing porosity-free castings. As a remedy, excessive venting of the molds up through the copes was recommended, although sand permeability was above 200 A.F.A. Sands were changed; coarse sands were introduced; and, after a few months, the epidemic appeared to have run its course.

A large percentage of the work, light in section, required quite hot metal, particularly since the greater portion of it had to be conveyed to the several molding floors and poured from two-man shank pots. After shake-out, the sand-blasted castings resembled porcupines, since the metal ran to unbelievable lengths through the openings created by provisions for venting.

At that plant operators of both

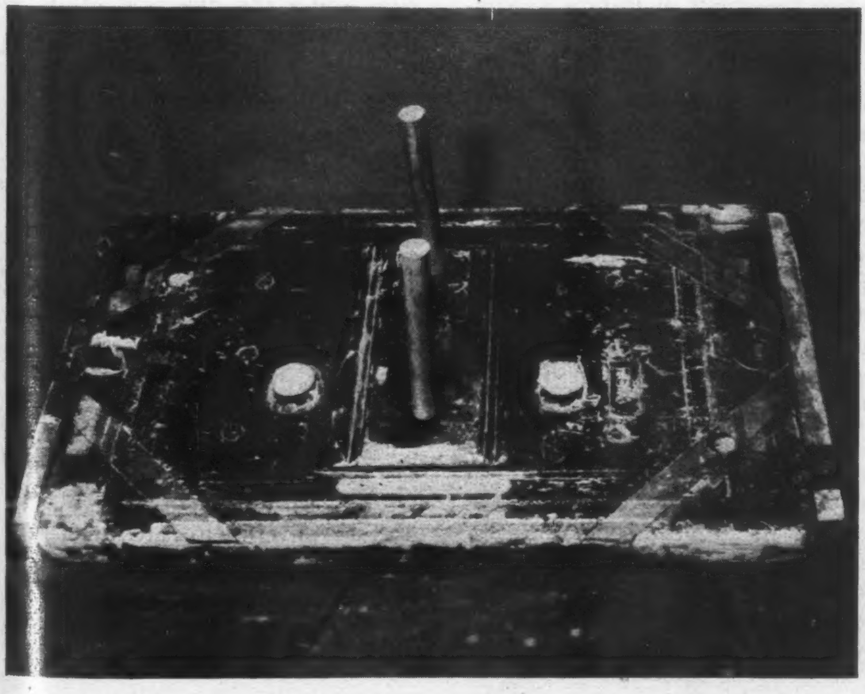


Fig. 2—Cope side of pattern (Fig. 1) showing the two points where sprues are punched through cope. Note the two 1-in. dowel sticks rammed up in cope and positioned directly over the venting system.

Fig. 4—(top) Four chaplets provided with vents. Dimensions are: $2\frac{1}{2}$-in. length provided with $1\frac{3}{4}$-in. round heads at both ends, 3/32-in. section, disks at centers tapered from 3/16-in. section at stem to knife edge at outside to $1\frac{1}{2}$-in. diameter. Fig. 5—(bottom) Four chaplets cast without vents in mold.

stationary and swing-frame grinders were compensated on the basis of pounds of metal removed. Before grinding, the castings were loaded on buggies and weighed. Since it was less difficult to remove much of the excess metal (cast metal vents, spikes and fins) by means other than grinding, the operators soon learned to work on the castings with sledges and coldcuts before grinding, thus increasing their earnings. The problem presented to the cleaning shop foreman was solved by assigning a man to the job of removing all vents and excess metal before weighing.

Examination of the castings prior to removal of the cast vents disclosed many instances of skin rupture at the re-entrant angle formed by the vent and the mold face. This rupture was caused by atmospheric pressure. It was also observed that many of the cast vents were only hollow tubular sections down to and, in some instances, below the contour of the castings.

As a possible explanation, it is suggested that the condition may have resulted from a prompt recession (aided by atmospheric pressure) of the probably very hot head of metal into the mold cavity, which left only the thin solidified tubular walls, the result of instant solidification of a film of metal.

Is there a steel foundry which has not experienced epidemics of porosity and immediately set about doing several things that; at least theoretically, offered relief? The measures usually are removal of a greater percentage of the fines; introduction of varying percentages of coarse sand; much venting of molds both up and down through, and down to the pattern in the drag, in order to "open up the sand."

Opening up of the sand has become the chief remedy, in addition to an immediate doubling of the amount of aluminum per ton—followed by still other additions to shank pots, a reduction of the moisture content of sand mixtures, and air- or skin-drying of a larger percentage of the molds. Eventually, all of these things are done, since they conform to the master pattern and are advocated by the metallurgical department. Yet, since the remedies do not help to fix the cause, they leave a foundryman no wiser after an epidemic than before.

Until quite recently, no one, to the writer's knowledge, has questioned the practice of venting. If, however, it is not demonstrably beneficial, if it serves no good purpose, yet is a source of dirt and cost increases, why continue it? The industry would not overlook a change of technique, method, new facility, supply or material that offered only a small portion of the saving possible by discontinuing venting.

In the average steel foundry shop orders and patterns are handled about as follows:

When the type and number of patterns are determined, patterns to be board mounted for machine molding are sent to the pattern shop. Then, the type of molding machine selected, the patterns are located on the boards, in conformity with gating and heading practice, under the direction of some individual or planning committee. It is at this point that venting is discussed, and the number, size and locations of the vents determined.

Pattern Markings

Most foundries provide such markings by attaching to the patterns various lengths of different sizes of inverted leather fillets, sheet lead strips, many sizes and designs of upholstery tacks, triangular and rectangular pieces of wood, wooden dowels, wooden seats for strain gates, flow-offs, and popsticks. The last named has become regular equipment. Instructions as to kind and size of vent wires are sometimes included in the legends marked on the equipment.

Considerable skill is required to carry out venting instructions. Par-

ticular care must be exercised in the withdrawal of vent wires to avoid dislodging portions of the mold face at right angles to vent openings.

To those who advocate the flat or rectangular vent in preference to the round, this question might be put: "Why vent at all?" The common and careless method of venting by jabbing wires through the copes of molds is a chief source of dirt.

It will be observed that, when metal is hot enough to run the character of castings being made, vent openings will fill with metal which must be removed in processing. Thus is rounded out a costly, useless sequence: pattern time to indicate vents; venting molds; molder's time; added cleaning time; loss of metal (reduction of yield); creation of sources of dirt which necessitate chipping for welding and increase cleaning costs, and the effects on items of material—all time-consuming and costly. Elimination of venting, on the other hand, will improve quality, increase production and decrease costs.

Porosity in Castings

Production of pinhole-free castings is primarily a problem of making the right kind of metal in the furnace. Porous castings are not, as steel foundrymen are often told, the result of: "insufficient venting;" "excessive moisture in the sand;" "sand too tight;" "sand not sufficiently permeable;" "sand rammed too hard or too soft;" "pieces of wood in the sand;" "too many fines;" "wet or undried cores;" "oxide on ladle lips;" "damp ladles;" or "just a molding condition" or "a job which would be better made upside down."

Is there a steel foundryman who has not racked his brain in the effort to overcome blow-off of small bosses into which chills or chill nails were placed? The problem applies more generally to smaller work, such as that made in slip flasks on jolt-squeeze machines, where displacement of mold cavities is restricted.

Factors to be considered in a determination of the probable cause of the blow-off include: displacement of mold cavity; size of the chill or chill nails used; moisture of the sand; location of the boss, and whether it is in the path of the metal flow or at the end of the mold cavity, and elapsed time from the closing of the mold until such time as it is poured.

Reservoir Provision

The only remedy for such defects, in the writer's experience, is to provide a sufficiently large reservoir at such points, so that the quantity of liquid metal available is great enough to generate into steam the moisture accumulated and attracted to the solid in its passing. These reservoirs cannot be classed as vents. They are actually small risers, since they invariably provide some feed metal to the casting after the violence of the metal has subsided. The fact that they feed metal to the casting provides a distinction between these reservoirs and vents or flow-offs.

The number of steel foundries which have discontinued venting of molds is not known. In foundries that have discontinued the practice definite savings of from six to ten dollars per ton have resulted on jolt-squeeze or slip-flask work.

Elimination of venting may arouse controversy and opposition among both personnel and supervision. However, a full realization of the need for cost reduction, plus careful experimentation, particularly to determine whether the metal is sufficiently hot to run a given character of work, should, in time, indicate that venting of molds does not contribute to the running of metal in any mold cavity.

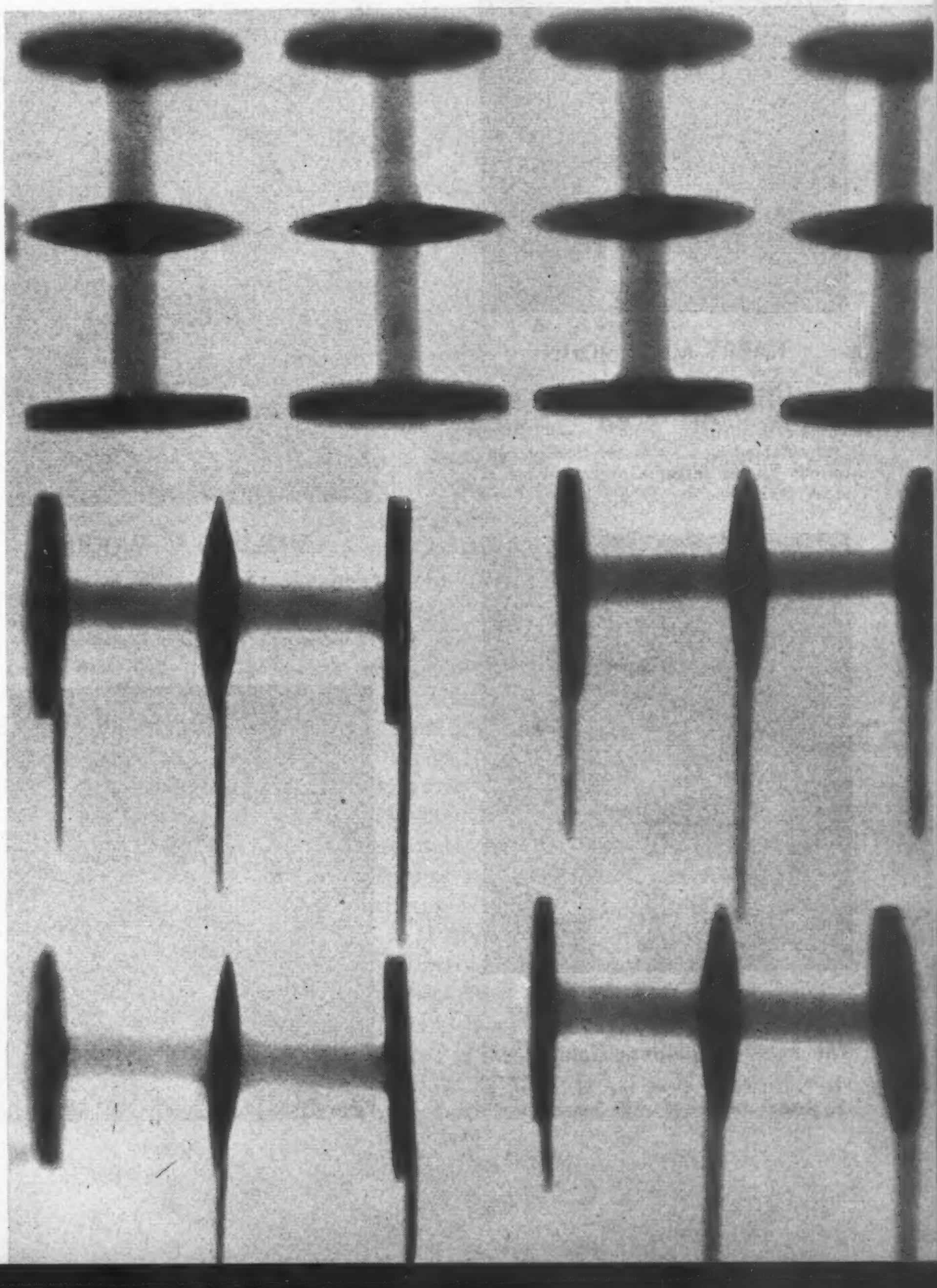
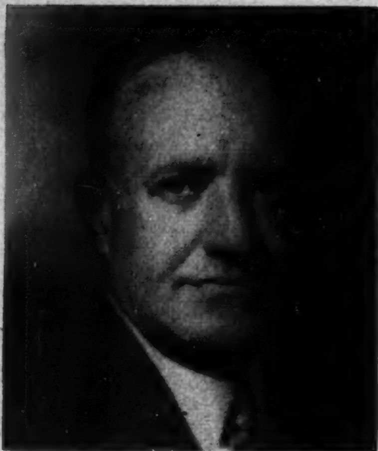


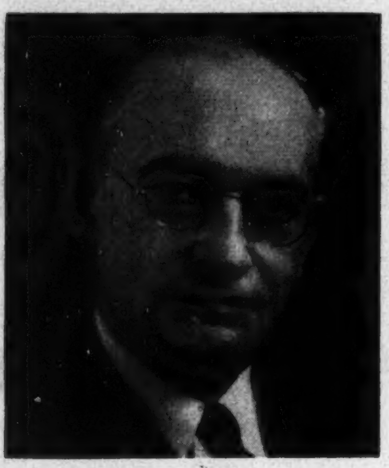
Fig. 6—Chaplets cast with and without vents subjected to gamma-ray inspection. Slight shrinkage occurs at junction of center disk and stem.



HENRY S. WASHBURN

The Joseph S. Seaman Gold Medal

"for outstanding service to the Association and valuable contributions to the gray iron castings industry."



HARRY M. ST. JOHN

The Wm. H. McFadden Gold Medal

"for outstanding work in the field of non-ferrous casting research over a period of many years."

RICHARD ALOYSIUS FLINN

The Peter L. Simpson Gold Medal

"for outstanding work the past year in the field of chilled and white iron castings."

RUSSELL J. ALLEN

The John A. Penton Gold Medal

"for his earnest and unceasing contributions toward the advancement of gray iron technology."

JOHN GRENNAN

Honorary Membership in A.F.A.

"for long service to the Association, collaboration in technical papers of value to the industry, and for constantly encouraging young men to enter the industry."

SHELDON V. WOOD

Honorary Membership in A.F.A.

"as the retiring President of American Foundrymen's Association."

AMERICAN FOUNDRYMEN'S ASSOCIATION MEDALISTS—1924-46

John H. Whiting Medal

FOUNDED IN 1923

1924—John Howe Hall
1926—E. V. Ronceray * (France)
1931—Ralph S. MacPherran *
1934—Dr. Arnold Lenz
1936—David McLain *
1937—Dr. James T. MacKenzie
1939—James Ramsay Allan
1940—Frederick Ketchum Vial
1941—Donald James Reese
1942—Alfred L. Boegehold
1944—Alfred W. Gregg
1946—Peter F. Blackwood

John A. Penton Medal

FOUNDED IN 1923

1924—Enrique Touceda *
1926—John Shaw * (England)
1930—Dr. Harry A. Schwartz
1932—LaVerne W. Spring *
1935—Lawrence Lee Anthes
1937—John Ward Bolton
1939—Harold Sands Falk
1940—Nathaniel K. B. Patch
1941—Frederick Louis Wolf
1942—John E. Galvin
1943—Rufus F. Harrington
1945—Clarence Edgar Sims

Joseph S. Seaman Medal

FOUNDED IN 1923

1925—Dr. Richard Moldenke *
1926—Thomas Turner* (England)
1927—Robert Alexander Bull *
1929—Jesse Lee Jones *
1933—Dr. Guilliam H. Clamer
1936—Dr. Heinrich Ries
1938—Frederick A. Lorenz, Jr. *
1940—Frederick A. Melmoth
1941—Charles Edgar Hoyt
1944—William G. Reichert
1945—Robert Edwin Kennedy

Wm. McFadden Medal

FOUNDED IN 1923

1925—Dr. Robert J. Anderson
1928—A. E. Outerbridge, Jr. *
1932—Dr. Horace W. Gillett
1937—Charles Willer Briggs
1939—Donald James Campbell *
1940—Harry Walter Dietert
1941—Max Kuniansky
1943—Carl F. Joseph
1946—Hyman Bornstein

Peter L. Simpson Medal

FOUNDED IN 1946

1946—Howard F. Taylor

* Deceased.

honors

SIX FOUNDRYMEN FOR MERITORIOUS SERVICE

HENRY S. WASHBURN, thirty-eighth president of the American Foundrymen's Association, expressed, in his presidential address, the conviction that the "challenge of the future calls for the very best that can be brought forward by every firm and every individual interested in the casting of metals."

In his service to the foundry industry and to A.F.A. Mr. Washburn personified that conviction and gave tirelessly; and in awarding him the Joseph S. Seaman Gold Metal, the Awards Committee cited his "outstanding service to the Association and valuable contributions to the gray iron castings industry."

Mr. Washburn, president of the Plainville Casting Co., Plainville, Conn., served as president of the Association in 1939-40. He was a director in 1935-38 and vice president in 1938-39. As a director he served on the executive committee and as vice president acted as chairman of the Association's divisional activities correlation committee.

Born in Brooklyn, Mr. Washburn received his early education at St. Paul's School, Garden City, N.Y., and later attended Yale University. He entered the commercial world as a bookkeeper for the Corn Exchange Bank of New York. From 1906 to 1917 he held positions as clerk, credit manager and office manager with the D.L. & W.R.R., H. B. Claflin Co., and Butler Bros. of New York City, and as purchasing agent and secretary, Turner & Seymour Mfg. Co., Torrington, Conn. He organized the Plainville Casting Co. in 1931, and has other business interests.

He is a member of the National Founders' Society, the Gray Iron Founders' Society, in which he has held office, and the Connecticut Foundrymen's Association.

HARRY M. ST. JOHN has wide recognition as a ranking non-ferrous chemist and metallurgist and will receive the Association's William H. McFadden Gold Medal "for his outstanding work in the field of non-ferrous castings research over a period of many years."

In his long record of A.F.A. committee service he has evidenced particular interest in electric melting, but his researches and cooperative activities have included all phases of non-ferrous foundry technology. TRANSACTIONS of the Association record his work on temperature control, brass foundry refractories, and researches in a determination of procedures for analysis of the defects of brass and bronze sand castings.

Superintendent of the brass foundry and forge shop of Crane Co., Chicago, since 1938, Mr. St. John, a native of Canajoharie, N.Y., was graduated from Cor-

nell University with a B.A. degree in 1910. After a three-year association with National Carbon Co., Cleveland, as research chemist, he became research engineer for Commonwealth Edison Co., Chicago. During World War I he served in the U.S. Army as Captain, C.W.S., and after the war became vice president of Detroit Electric Furnace Co., a post he held until 1923, when he joined the Detroit Lubricator Co. as chief metallurgist.

Mr. St. John has served as chairman of the Association's Annual Lecture Committee for a number of years, and is currently a member of the Brass and Bronze Division Executive Committee and a member of the Division's Committee on Recommended Practices for Non-Ferrous Alloys. His past service includes the chairmanship of the former non-ferrous division. In that field he has distinguished himself as a leader and policy-maker.

Dr. Richard A. Flinn, credited with a number of noteworthy contributions to gray iron and steel metallurgy, will receive the Peter L. Simpson Gold Metal of A.F.A. "for outstanding work during the past year in the field of chilled and white iron castings."

A native of New York City, Dr. Flinn was graduated from the College of the City of New York with a bachelor of science degree in chemical engineering in 1936. A year later Massachusetts Institute of Technology conferred on him a master of science degree and in 1941 honored him with the degree of doctor of science in physical metallurgy.

Dr. Flinn's industrial experience began in 1937 in an association with International Nickel Co., Inc., as a research metallurgist. In 1941 he joined American Brake Shoe Co. as assistant metallurgist and two years later advanced to metallurgist. At present he is engaged in the development of ferrous alloys of improved wear and heat resistance as a member of the company's research group in Mahwah, N.J.

His technical writings include an outstanding paper on "Control of Cast Metal Structures and Their Relation to Casting Property and Service Life."

Dr. Flinn was awarded the Henry Marion Howe medal of A.S.M. in 1944 as co-author, with Earnshaw Cook and J. A. Fellows, of a paper titled "A Quantitative Study of Austenite Transformation."

He is Chairman, A.F.A. Committee on Test Bar Design, Gray Iron Division, and serving as a member of that Division's Executive, Fluidity Testing, Heat Treatment and Section Size Relationships committees.

Dr. Flinn is a charter member of the Association's Metropolitan chapter, and also holds memberships in A.S.M., A.I.M.E. and the American Society of Experimental Stress Analysis.

Russell J. Allen, of Harrison, N.J., is nationally known in foundry circles. Few have been more active in the work of the Association's Gray Iron Division; and in selecting him to receive the John A. Penton Gold Medal, the A.F.A. Board of Awards cited "his earnest and unceasing contributions toward the advancement of gray iron metallurgy."

Mr. Allen has been associated with the Worthington Pump & Machinery Corp. as metallurgical engineer since 1929. Previously, in a connection dating from 1918, he was identified as a metallurgist with Rolls Royce of America, Inc., at Springfield, Mass. He was graduated from the University of Toronto in 1913 with a B.A. degree in science.

Although he was written on metallurgical subjects, Mr. Allen has placed major emphasis on cooperative activities as a force in the dissemination of technical information and the advancement of foundry technology and centered his effort in A.F.A. committee work.

Probably his most important present committee assignment is the chairmanship of the Gray Iron Division Program and Papers Committee. He is also Vice Chairman of the Division's Executive Committee and Chairman of the Committee on High Temperature Properties of Cast Iron.

Other technical societies with which he is affiliated include the American Welding Society, the Institute of Metals (British), A.I.M.E., A.S.M. and the A.S.T.M.

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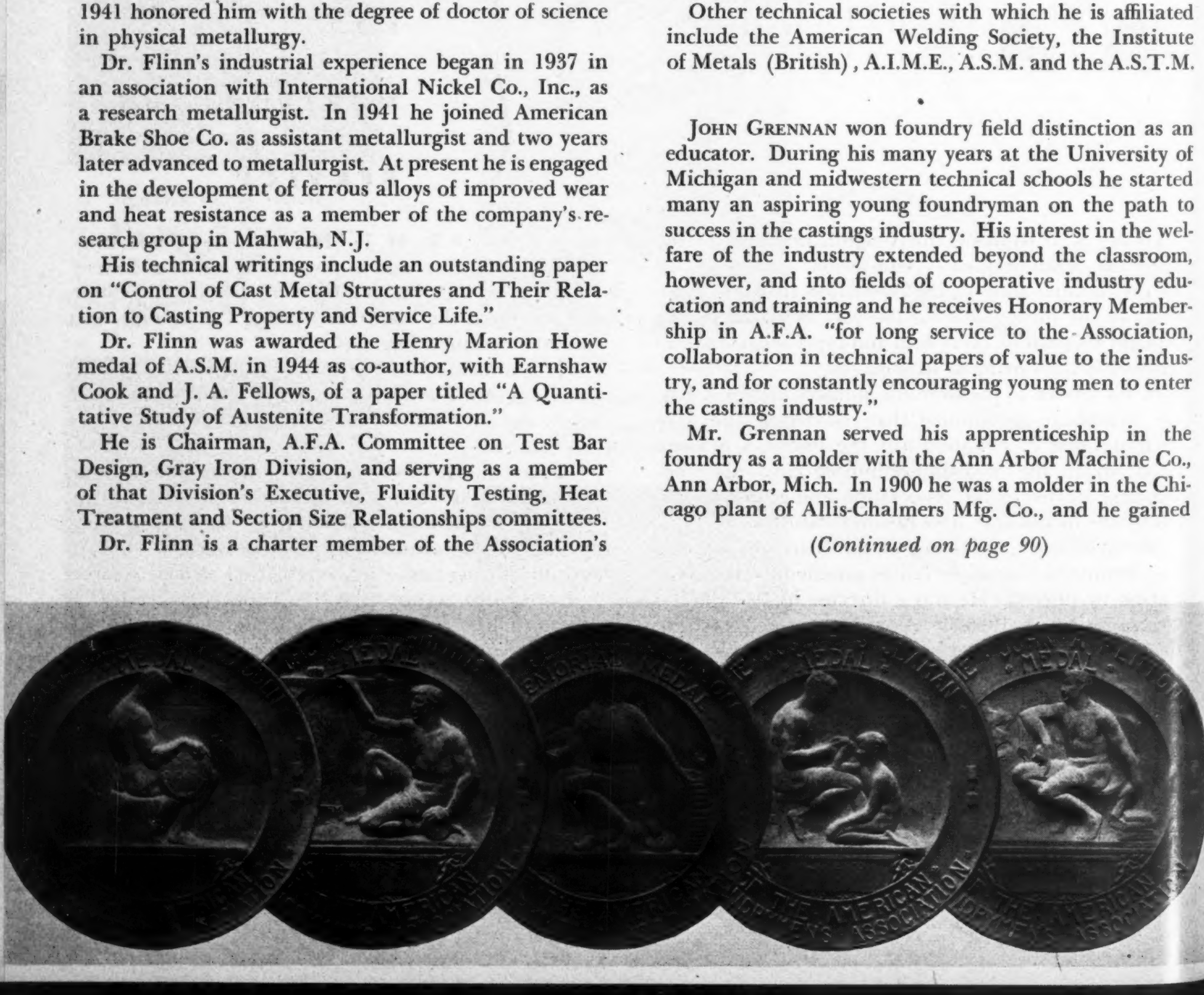
John Grennan won foundry field distinction as an educator. During his many years at the University of Michigan and midwestern technical schools he started many an aspiring young foundryman on the path to success in the castings industry. His interest in the welfare of the industry extended beyond the classroom, however, and into fields of cooperative industry education and training and he receives Honorary Membership in A.F.A. "for long service to the Association, collaboration in technical papers of value to the industry, and for constantly encouraging young men to enter the castings industry."

Mr. Grennan served his apprenticeship in the foundry as a molder with the Ann Arbor Machine Co., Ann Arbor, Mich. In 1900 he was a molder in the Chicago plant of Allis-Chalmers Mfg. Co., and he gained

(*Continued on page 90*)



MAGNESIUM ALLOYS

Marvin E. Gantz
Metallurgist
American Magnesium Corp.
Cleveland

SMALL CALCIUM ADDITIONS

Calcium additions in magnesium foundry sand work have certain definite advantages and some attendant disadvantages. In certain instances, the advantages of employing calcium in the production of magnesium alloy castings are sufficient to warrant changes in technique which may be necessary to obviate any disadvantage resulting from its use.

It is quite probable that the majority of manufacturers of magnesium alloy products have, at one time or another, investigated the effects of small additions of calcium on the quality of their products. It may be of general interest, therefore, to describe the technique adopted by the American Magnesium Corp. for making calcium additions, and discuss some of the advantages and disadvantages of using calcium.

Additions to be considered constitute a small percentage of the composition of the various magnesium alloys, but they may exert a rather profound effect on the quality of the article being produced. This subject naturally divides itself into two principal parts: (1) the use of calcium in the fabrication of wrought products, and (2) calcium additions in production of magnesium alloy sand castings.

Since the practice of adding calcium in the production of magnesium alloy sheet and extrusion products is rather generally known and accepted, the greater portion of the paper will be devoted to discussing the less familiar use of calcium, namely, in the production of magnesium alloy castings. In order to avoid confusion, the various magnesium alloys will be referred to in terms of their ASTM designations.

Calcium in Wrought Products

In the preparation of sheet ingots of AZ31X alloy, calcium is employed in the amount of 0.1-0.20 per cent by weight of metal used for casting the ingots. The purpose of this addition to the sheet ingots is to enhance their hot rolling characteristics and improve the mechanical properties of the sheet.

In many instances, it is possible, by means of a calcium addition, to roll sheet directly from ingot, whereas if calcium were not employed it would probably be necessary to use extruded billets for rolling stock. Calcium is added in the amount of about 0.08-0.14 per cent to M1 alloy sheet ingots to refine the grain, improve hot rolling characteristics and enhance the mechanical properties of M1 alloy sheet. If calcium were not used, many lots of sheet would be rejected because of insufficient elongation.

It should be noted, however, that the calcium content of sheet must be closely controlled. Excessive amounts of calcium increase the occurrence of cracks in fusion welds that cool under restraint. Calcium is employed in M1 alloy extrusion ingots to refine the grain, increase mechanical properties and improve the surface quality of extruded tubing, bars and shapes.

Usage in Sand Foundries

The application of calcium in sand foundry work is not as widely accepted as is its use in the production of wrought products. As a matter of fact, however, calcium additions are considered to be as much an integral part of the manufacture of sand castings as they are in producing wrought materials.

In order for calcium to be of benefit in foundry work, it must be properly used. A brief description of the method employed for making calcium additions in sand foundries might be of interest.

Calcium is added in the amount of 0.05 per cent to almost all AZ92 alloy metal poured and to some AZ63 alloy melts. The calcium is purchased in slab form and cut to size on a shear. Pieces of calcium of the required weight are wrapped in wire and kept in kerosene until just before use. The purpose of the kerosene is to prevent the surface of the calcium from becoming unduly oxidized.

When a piece of calcium is introduced into molten magnesium or a magnesium alloy, it will both melt and dissolve if the temperature of the molten metal is above the fusion point of calcium. Otherwise, simple solution of the calcium in the melt will occur. A badly oxidized surface on the calcium greatly retards its rate of solution.

Calcium Addition Technique

The actual addition operation consists of grasping the wire to which the calcium is affixed and plunging the calcium beneath the surface of the metal, after first allowing the excess kerosene to burn off. The calcium addition is made to each crucible of metal 5 to 10 min before the metal is poured into castings. The 5- to 10- min holding time between the calcium addition and the pouring of castings is imposed for two reasons:

1. There is some evidence that castings poured immediately following the calcium addition tend to be coarser grained than castings poured 5 min or more after calcium has been introduced.

2. The calcium content of a melt decreases with holding time, and not enough calcium will remain in the molten metal if it is held much longer than 10 min after the addition has been made. Some tests were run to determine the rate at which the calcium content of a crucible of molten AZ92 alloy decreases with time. In this work 0.05 per cent of calcium was added at about 1500 F and the metal then held above 1450 F. The calcium content of the melt at the end of


A
B
C
D

15 min holding was about 0.035 per cent, at the end of 30 min it was 0.015 per cent, and after the metal had been held 40 min only 0.01 per cent of calcium remained.

When the calcium is introduced into a crucible of molten metal, care should be taken to keep it from contacting the flux covering on the metal and any flux heel in the crucible. The reason for this precaution is that calcium has more affinity for chlorine at the temperature at which this operation is performed than has magnesium and will, therefore, react with magnesium chloride to form calcium chloride. Magnesium chloride is a major constituent of most furnace room fluxes.

A full 0.05 per cent calcium addition must be made to each crucible of metal regardless of the amount of remelt charged. This is because calcium is almost completely removed in each melting cycle by the flux refining operation.

Fig. 1—Radiograph illustrating the beneficial effect of a calcium addition in increasing the height of sound metal in wedges of AZ63 alloy. Wedges A and B are from metal containing no calcium. Approximately 0.05 per cent of calcium was added to metal from which wedges C and D were poured.

Effects of Calcium Additions

Calcium additions of the order of 0.05 per cent to magnesium foundry alloys such as AZ92 and AZ63 are of considerable benefit in (1) reducing the occurrence of microporosity in magnesium alloy castings, (2) decreasing the length of time required for obtaining a satisfactory solution heat treatment of castings, and (3) reducing the rate of oxidation of molten magnesium alloys. The use of calcium, unfortunately, also has some disadvantages which will be mentioned later.

1. *Reduction of Microporosity*—The mechanism by which calcium reduces microporosity in magnesium alloy castings is not completely understood. It appears, however, to be concerned with the hydrogen content of the melts. It is rather well known that hydrogen dissolved in molten magnesium alloys frequently increases the number and size of microporosity voids in castings from such melts.

One explanation for the effect of hydrogen on the occurrence of microporosity is that as a casting freezes hydrogen diffuses into the interdendritic voids formed as solidification progresses. The pressure of liquid metal from other sections of the casting and from the risers acting to fill the voids in the portion which is already solid will be opposed by the pressure of any gas present in these voids.

Feeding Efficiency

Pressure by the liquid metal is equal to the head of molten metal plus the atmospheric pressure exerted on the still molten riser surfaces. When the pressure of the hydrogen equals that of the molten metal, the voids will not be filled. Thus, feeding efficiency is reduced.

The principal source of the hydrogen dissolved in molten magnesium alloys is moisture with which the metal reacts. This moisture may be introduced in or on the metal charge, in the flux, by use of improperly dried implements such as stirring rods and skimmers, and by the atmosphere. One of the most common means by which moisture and hence hydrogen is introduced is by stirring flux through the molten metal before the flux has had a chance to fuse properly on the surface of the melt.

A possible reason for the observed beneficial effect of calcium in reducing microporosity in magnesium alloy melts is that the calcium fixes the dissolved hydrogen present, perhaps as a hydride, and thus prevents it from precipitating during solidification. The benefits resulting from the use of about 0.05 per cent of calcium may be satisfactorily demonstrated by means of a wedge-type test casting.

The test casting employed is a slight modification of a wedge casting used by the Battelle Memorial Institute [1] to compare the relative tendencies of magnesium alloy melts to produce castings containing microporosity. The wedge is about 9½ in. long, 7 in. high, and tapers from 2½ in. wide on the cope surface down to a ½-in. width in the drag section of the casting.

Amounts of microporosity present in the various wedges are compared by cutting vertical sections ½-in. thick from the center of each wedge perpendicular to the long axis. These sections are then examined microscopically or radiographically to determine the distance from the bottom of each wedge to the first appearance of microporosity. These distances are termed the heights of sound metal in the wedges and are used as the basis for wedge comparison.

Improvement resulting from the use of calcium can be shown by comparing the heights of sound metal in wedges poured from melts to which 0.05 per cent of calcium has been added, with the heights of sound metal in wedges from melts to which no calcium additions have been made. In wedge tests made by one of this company's foundries, using AZ92 alloy, it was found that the height of sound metal in calcium-containing wedges averaged about 3 in., while the average height of sound metal in wedges without calcium was ¾-in.

This degree of improvement can only be expected, of course, if the calcium addition is properly made and no other degassing operation is performed upon the metal. Figure 1 illustrates the beneficial effects of a calcium addition on the height of sound metal in wedges cast of AZ63 alloy.

Value in Heavy Sections

Calcium additions have been found to be of more benefit in reducing microporosity in castings containing heavy sections than in thin-walled castings. This is true, in general, of materials used to degas molten magnesium alloys.

Frequently, it is much easier to demonstrate the advantage of a degassing operation on metal used to pour castings containing heavy sections than it is on metal from which thin-walled castings are poured. It would appear that when a uniformly thin-walled casting is being considered, obtaining maximum grain refinement is more important than removing all the dissolved hydrogen which may be present.

There is some indication that additions of calcium greater than

the 0.05 per cent now employed would be of increased benefit in reducing microporosity. Larger additions, however, impose a heat treating problem which will be discussed later.

2. *Effect of Calcium on Solution Heat Treating Operations*—The second advantage that is claimed for the use of calcium additions in magnesium sand foundry work is that these additions facilitate the solution heat treating operations. Employing calcium makes it unnecessary to resort to preheating cycles in performing solution heat treatments on AZ63 and AZ92 alloy castings.

It is true that the presence of 0.05 per cent calcium slows down the rate of solution heat treatment at a given temperature, but this is more than offset by the fact that castings containing a nominal 0.05 per cent calcium can be heat treated at a higher temperature than castings to which no calcium addition has been made.

The actual increase in permissible heat treating temperature which may be attained depends on the alloy and also on the amount of calcium employed. With a 0.05 per cent calcium addition, the heat treating temperature of the common casting alloys may be increased 10-20 F. According to some authors, a 20 F increase in solution heat treating temperature will about double the rate of solution.

It must be remembered, however, that the presence of calcium in the alloy reduces the rate of solution at a given temperature. The result of the combination of these two factors is that the use of calcium in magnesium alloy castings reduces the length of time which the castings must be held at solution heat treating temperatures by about 20 per cent, and eliminates the necessity of a controlled preheating period for AZ92 and AZ63 alloy castings.

These benefits may be partially explained by the observation that the use of calcium appears to increase the temperature at which eutectic melting takes place and resulting eutectic phase formed.

It is interesting to note that investigators have reported that it was quite difficult to heat treat AZ92 and AZ63 alloy castings without obtaining some burning, even when the heat treating was done under laboratory conditions.[2] If the results obtained are significant, it would seem that the use of calcium in AZ92 and AZ63 not only simplifies the heat treatment of sand castings from these alloys, but also makes the results more dependable.

Character of Burning

It must be admitted, however, that the burning reported by the investigators consisted of both eutectic melting and high-temperature oxidation, with the latter being perhaps more prevalent. Calcium additions are of little or no benefit in preventing occurrence of high-temperature oxidation.

A question which might logically be asked at this point is, if 0.05 per cent of calcium is beneficial, would not larger amounts be of even more advantage? The difficulty in using additions of calcium in excess of 0.05 per cent is that although the permissible solution heat treating temperature may be increased slightly by means of such additions, the rate of solution of the beta phase is so decreased that ability to use slightly higher temperature is of no advantage.

To illustrate this, assume that a typical engine part is being made in A10 alloy without calcium, and castings of this part are given a solution heat treatment which consists of 20 hr at 780 F. If 0.25 per cent of calcium were to be added to the metal from which these castings are poured, the heat treatment to attain a similar degree of solution would have to be at least 30 hr at 810 F. Obviously, the 0.25 per cent calcium addition would be of no benefit in this instance in the heat treatment.

Low Zinc Alloys

Use of calcium is of more benefit in simplifying and shortening the heat treatment of castings from alloys such as AZ92 and AZ63 than it is in that of castings from the alloys containing little or no zinc. The reason for this is that it eliminates the necessity for the preheating operation frequently employed in the solution heat treatment of the Mg-Al-Zn type alloys.

3. *Reduction in Rate of Oxidation*—The effect of calcium in reducing the rate of oxidation of molten magnesium alloys is quite generally known. In *The Technology of Magnesium and Its Alloys,* by Adolph Beck, it is stated, "It is remarkable that calcium, when present in these small amounts (about 0.25 per cent), should reduce the rate of oxidation of the molten metal."

To take full advantage of the beneficial effect of calcium in reducing the rate of oxidation, it would be desirable to increase the calcium additions from the 0.05 per cent now employed to about 0.25 per cent, but the attendant heat treating difficulties which would be encountered prevent this.

Calcium Disadvantages

Having considered some of the advantages resulting from adding small amounts of calcium to melts from which magnesium alloy castings are to be poured, attention now should be called to some of the disadvantages of using calcium. The fact has already been mentioned that while calcium additions in the neighborhood of 0.05 per cent facilitate the heat treatment of magnesium alloy castings, larger amounts of calcium may make heat treatment more difficult.

4. *Effect on Hot-Cracking Tendency*—One of the more frequently mentioned difficulties resulting from the use of calcium additions in magnesium foundry alloys is that they are considered to have a tendency to cause coarse-grained castings and increase the number of castings scrapped because of hot cracks. By a hot crack is meant one which occurs above the equicohesive temperature of the alloy. This type of defect is characteristically intergranular, and generally there is definite evidence of oxidation in the fracture showing that the section still was hot when the crack occurred.

The results of some tests run to determine what effect the addition of calcium has on the hot-cracking susceptibility of AZ92 alloy show that, under certain conditions, calcium *reduces* the hot cracking susceptibility of castings from this alloy. This is true only when fine-grained castings are involved. A 0.05 per cent calcium addition

Fig. 2—Examples of truncated cone-shaped test castings used to determine effect of calcium additions on hot-cracking susceptibilities of various magnesium alloys. Note the hot cracks adjacent to the vertical slot gates in the test castings.

may, under certain conditions, increase the grain size of castings which, in turn, exerts a deleterious effect on resistance to cracking.

It might be interesting to mention briefly the test procedure adopted for comparing the hot-cracking susceptibilities of various alloys and the effect of calcium additions on this property. The experimental work consisted of pouring truncated cone-shaped castings using solid graphite cores. The castings were about 7 in. high and tapered from a diameter of 7 3/32-in. at the base to 2 11/32-in. The wall thickness was 3/8-in.

Because of the non-collapsible character of the graphite core, a good deal of stress is set up as a casting shrinks around this core. This stress varies along the slant height of the core, with the maximum stress at the base.

The stress gradient makes it possible to get a quantitative measurement of the susceptibility to hot cracking of individual melts of metal by making a single cone casting. Examples of these test castings are shown in Fig. 2. The cracks adjacent to the vertical slot gates can be readily seen.

Hot Cracking Susceptibility

It was found in these tests that the grain size of melts to which calcium was added could be satisfactorily controlled by the following procedure: (1) flux refining at 1350 to 1380 F; (2) superheating to temperature of 1750 F; (3) adding the 0.05 per cent calcium at 90 F above the pouring temperature, or at least 5 min before pouring.

As already mentioned, if a calcium addition is made to a crucible of metal, a short holding time should be provided after the calcium has been added. It should be again stated for emphasis that calcium additions, if properly made, are of benefit in reducing the susceptibility of certain type castings to a hot-cracking type of defect.

5. *Influence of Calcium Additions on Occurrence of Skins*—Probably the most serious drawback to the use of 0.05 per cent calcium additions in magnesium foundry work is the fact that these additions to certain alloys appear to increase the incidence of skins in castings poured from the alloys.

This defect is essentially a metallic foam composed of bubbles of air or mold gases wrapped in partially oxidized films of metal caused by undue turbulence of the metal as it flows through the mold cavity. Skins often are encountered on the cope face of the casting, although they may become trapped almost anywhere in the casting.

One possible explanation for the deleterious effect which calcium additions have on the occurrence of skins is that the calcium increases the apparent surface tension of molten magnesium alloys and might, therefore, logically be expected to increase the incidence of skins in castings not properly gated. Just why this effect of calcium appears to be more serious in some alloys than in others is not clear.

Effect of calcium in increasing the surface tension of molten magnesium alloys is most deleterious when metal to which a calcium addition has been made is poured into sand molds containing fluoride inhibitors. A considerable amount of work was done some time ago to investigate the possibility of using fluoride compounds as protective agents in molding sand heaps. The use of these inhibitors, however, resulted in a tremendous increase in misruns and the occurrence of folds in castings. It is thought that the difficulties which were encountered could be attributed to the combination of fluoride inhibitors in the molding sand and calcium in the alloys.

Although calcium additions probably would be of advantage in permanent mold work, they are not generally employed because of the difficulty of exercising adequate control of the calcium content of permanent mold castings.

Summary

To summarize, small amounts of calcium are added to metal cast into sheet ingots of alloys AZ31X and M1 to improve the hot rolling characteristics of the ingots and to enhance the mechanical properties of the sheet. Calcium additions also are made to metal cast into extrusion ingots of M1 alloy to improve the surface quality and the mechanical properties of extruded tubing, bars and shapes.

Calcium additions in magnesium sand foundry work have certain definite advantages and some attendant disadvantages. In the foundries of the company with which the author is associated, calcium is added in the amount of 0.05 per cent in almost all AZ92 alloy work and in some AZ63 alloy castings.

The beneficial effect of 0.05 per cent calcium additions in reducing microporosity in castings of magnesium alloys such as AZ92 and AZ63 can be easily demonstrated. This improvement in quality is more apparent in some castings than in others.

Use of 0.05 per cent calcium in magnesium alloy sand castings decreases the length of time required for obtaining a satisfactory solution heat treatment of the castings and eliminates the necessity for preheating cycles in the solution heat treatment of castings of the Mg-Al-Zn alloy type.

Solution Rate

Additions larger than the 0.05 per cent normally employed may actually increase the length of time required for satisfactory solution heat treatment because calcium decreases the rate of solution at any given heat treating temperature. The use of calcium makes it possible to employ somewhat higher heat-treating temperatures.

Calcium additions reduce the rate of oxidation of molten alloys. This benefit may result from the formation of a partially protective film on the exposed surface of the molten metal. If such a film is formed, it would explain the observed apparent increase in surface tension of molten magnesium alloys to which additions of calcium have been made.

Contrary to what is generally considered to be true, calcium additions can be beneficial in reducing the incidence of hot cracks in certain magnesium alloy castings.

Calcium additions in certain alloys apparently tend to increase the occurrence of skins in castings from metal so treated. This may be partially combatted by improving the gating of the affected castings to reduce turbulence of the metal stream flowing through the mold cavity.

Thus, it appears logical to conclude that, in certain instances, the advantages of employing calcium in the production of magnesium alloy castings are sufficient to warrant changes in technique which may be necessary to obviate any disadvantages from its use.

References

1. James DeHaven, James A. Davis, and L. W. Eastwood, "Reduction of Microporosity in Magnesium Alloy Castings," AMERICAN FOUNDRYMAN, June, 1945, pp. 44-53.

2. L. W. Eastwood, James A. Davis, and James DeHaven, "Comparison of the Common American and European Magnesium Casting Alloys," AMERICAN FOUNDRYMAN, Dec., 1945, pp. 54-67.

Names Sand Division Executive Committee

Dr. H. RIES, Ithaca, N. Y., Chairman, A.F.A. Sand Division, has announced the personnel of the Executive Committee of his group, which was organized recently as the seventh division of the Association. P. E. Kyle, Cornell University, Ithaca, serves as Vice-Chairman of the Division. Other members of the committee are:

B. H. Booth, Carpenter Bros., Inc., Milwaukee; J. B. Caine, Sawbrook Steel Castings Co., Cincinnati; H. W. Dietert, Harry W. Dietert Co., Detroit; G. R. Gardner, Aluminum Co. of America, Cleveland; H. M. Kraner, Bethlehem Steel Co., Bethlehem, Pa.; A. I. Krynitsky, National Bureau of Standards, Washington, D. C.; R. E. Morey, Naval Research Laboratory, Washington, D. C.; W. G. Parker, Elmira Foundry Co., Elmira, N. Y.; J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind.; D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn.; H. F. Taylor, Massachusetts Institute of Technology, Cambridge, and E. C. Zirzow, National Malleable & Steel Castings Co., Cleveland.

APPRENTICE CONTEST RESULTS

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FOUNDRY OPERATIONS, like those in all modern industrial enterprises, require the teamwork of many individuals and different departments. One operation, the molding of castings, is of great importance in the success or failure of the casting process. Poor molding practice may result in low yield of metal poured to casting weight. Improperly set cores and shifted molds cause many scrap castings. Proper gating and the judicious use of risers are necessary to insure soundness. Sand must be properly rammed to eliminate scabs and other casting defects. These are but a few of the many factors to be considered by a molder if a satisfactory casting is to be made.

Apprentices who enter the A.F.A. Annual Apprentice Contest are to be admired for their attempts to cope with the numerous molding problems, and those who win are to be congratulated. All who enter gain valuable experience which they will be able to use in pursuit of a career in the castings industry.

The discussion which follows is not intended as criticism. Special methods are used in different foundries and different localities. What may be considered good practice in one place is frowned upon in another foundry or locality.

The castings made by the three prize winners in the gray iron molding division (Fig. 1) of the 1946 A.F.A. Annual Apprentice Contest are good commercial castings and would pass ordinary visual inspection without difficulty.

First prize was won by Lawrence Kinsinger, Caterpillar Tractor Co., Peoria, Ill., with a score of 90.6. His molding time was 80 min. Estimated yield is 75 per cent, which is fairly good. The casting is free from surface defects and the gating permits easy removal of risers.

The casting was poured into the heaviest section, the sprue acting as a feeder, and with a second feeder going to the heavy boss. This insures proper feeding of the casting.

Second place was taken by M. Tamborini, Warden King Ltd., Montreal, Que., with a score of 84.6. Molded in two hours, the casting was poured through a light sprue to a heavy section which has a large open riser atop to feed it. No attempt was made to feed the boss. The yield is somewhat lower than the first-place casting. Scabbing and veining near the parting line and a small sand hole near the ingate detract from the appearance.

Third place was taken by Harold Young of the Cleveland Trade School with a score of 77.0. Again the yield has declined because a large riser was placed alongside the heavy section and the casting was poured through a sprue into this riser. There were several small blow and sand holes and some scabbing. Molding time was 70 min.

One contestant attempted about

4

5

6

a 95 per cent yield. His casting (Fig. 2, left) was poured through the large boss and there was a small open riser on the top boss of the yoke. As a result the heavy section showed a depression which in an industrial foundry would be cause for rejection of the casting. The casting was severely finned at the heavy section.

On the other extreme, three contestants used far too much metal for gray iron. One (Fig. 2, right) had an estimated 50 per cent yield and had finned badly. Another had a better yield and was a fairly sound casting. However, a riser on top of the heavy section was made with a long neck and might have broken off into the casting or necessitated excessive grinding in the cleaning.

The riser on another casting could not have been broken off at all. In addition, it had a bad scab which would have incurred considerable clean-up cost.

The influence of training in the use of atmospheric pressure risers is shown by two winners in the steel molding division, both of whom were from Crucible Steel Casting Co., Cleveland.

The steel division contest was won by Robert Bina with a score of 88 and a molding time of 48 min. One large atmospheric pressure riser fed the heavy section, and the estimated yield is 60 per cent (Fig. 3). Two chill nails were used on the boss at the other end of the casting. Two defects on top of the heavy section, which look like gas pockets, would have been eliminated by proper mold venting.

John Pietrzyke took second place with a score of 82 and a molding time of one hour. However, in this case, two pressure risers are used with a resultant lower yield. Chill nails were used on the bosses with excellent results. The casting has only one defect, a sand hole in the lower boss. On the whole, it is somewhat better in appearance than the first-place casting. However, the lower yield and the greater molding time made the difference in the net scores, which are close. Also, there are two gates to be burned off and ground.

Third place was taken by Jim Kraynak of West Steel Casting Co., Cleveland, with a score of 79 and a molding time of 29 min. The metal was poured directly into a riser on top of the heavy section (Fig. 3, right). The yield could have been improved by using a much lower riser. The riser should have necked in somewhat more to facilitate removal and cleaning. Chill nails were used on all bosses and too many were used. Care was not exercised in removing pattern from mold, resulting in extreme roughness in the fillet radius and excess metal around two bosses.

Steel Casting Yields

All other castings in the steel division had poor yields and would have been difficult to clean. An attempt was made in every case to feed each boss separately. In two cases (Fig. 4) pressure risers were used to feed one boss, a large open riser fed the heavy section and a small open riser fed the boss at the small end of the casting. Estimated yield is 40 per cent or less.

Castings which won prizes in the non-ferrous division (Fig. 5) were similar in gating, and all had a yield of approximately 60 per cent. In the case of the first- and second-place winners, the judges showed their skill in differentiating between the work of two apprentices, trained under identical conditions, who used nearly identical gating techniques.

C. Corriveau, Montreal Technical School, was first with a score of 86 and a molding time of 55 min. The casting is ingated to an open riser and then into the heavy section of the casting. The surface of the casting is smooth and free

from defects. The mold must have been closed carefully for there is but little finning at the parting line. One must examine the casting closely to determine where it was parted, this being before any clean-up or grinding other than blasting. Yield is estimated at 60 per cent.

Training Value

P. Blais, also of Montreal Technical School, was second with a score of 79. His molding time was two hours and his gating is practically identical with that of the first-place winner. This emphasizes strongly the value of good apprentice training and the responsibility foundries must assume for the caliber of men they turn out.

The care used in drawing the pattern and closing the mold was not as great as for the first-place casting. There is some finning and the parting line is rough. However, the casting seems to be sound and has a good appearance. The factors of greater time in molding and the finning of the casting were the difference between first and second place.

H. Dechamps of Jenkins Bros., Montreal, took third place with a score of 77.3 and a molding time of one hour. The gating of this casting is about the same as that of the first- and second-place castings and demonstrates local training and practice. The molder did not use sufficient care in drawing his pattern and closing the mold, with the result that the parting line is rough and there is excessive finning.

Low Non-Ferrous Yields

Five other castings were entered in the non-ferrous division. Three of these were so heavily gated that the yield is less than 25 per cent in one case and not greater than 40 per cent in the others. One casting was gated at the light end, similar to the gray iron castings, and in consequence has a depression in the heavy section due to lack of metal to feed the casting. The appearance of this casting is poor due to a loosely rammed mold and insufficient care in lock-up.

In general, the winning castings were very good. This speaks well for the apprentices and their approach to the problems involved. There was a little evidence of poor workmanship due to inexperience.

WESTERN METAL EXPOSITION Will Feature Strong Foundry Program

SUBJECTS TOUCHING BASIC phases of foundry operations are featured on the program of the Northern California chapter of A.F.A. for the Western Metal Exposition and Congress, in Oakland, Calif., March 24-27, inclusive. All A.F.A. sessions will be held at Hotel Leamington. The A.F.A. Congress Subcommittee is headed by Richard Vosbrink, Berkeley Pattern Works, Berkeley, Calif., President of the Northern California chapter.

Don Follet, Oakland Chamber of Commerce, will address the opening session on "The Future for Industry in the West," and Mr. Vosbrink will preside. Highlights of the meeting were announced by H. M. Nystrom, Vulcan Steel Foundry Co., Oakland, A.F.A. Program Chairman for the Congress.

The foundry program is divided into ten parts, each session covering a specific subject. A chairman, co-chairman and speaker have been assigned for each subject as follows:

Aluminum Castings—March 24 (2:00-3:25) Chairman: Leon Cameto, Production Foundry Co., Oakland; Co-Chairman: James Lynch, Jr., Lynch Brass & Aluminum Foundry, Oakland; Speaker: Roy Paine, Director of Research, Aluminum Co. of America, Los Angeles.

Brass and Bronze Castings—March 24 (3:30-5:00) Chairman; F. A. Mainzer, Pacific Brass Foundry, San Francisco; Co-Chairman; H. E. Eggerts, Berkeley Brass Foundry, Berkeley; Speaker: George Dreher, A.F.A. National Director, Los Angeles.

Core Blowing — March 25 (2:00-3:25) Chairman; Harry Bossi, Macaulay Foundry, Berkeley; Co-Chairman: Hugh Prior, Enterprise Engine & Foundry Co., San Francisco; Speaker: L. D. Pridmore, Vice-President, International Molding Machine Co., Chicago.

Foundry Sands—March 25 (3:30-5:00) Chairman: N. E. Schlegel, Vulcan Foundry Co., Oakland; Co-Chairman: George Stewart, Pacific Brass Foundry Co., San Francisco; Speaker: H. E. Henderson, (Iron); J. L. Francis, (Steel); George Stewart, (Non-Ferrous).

Steel Castings — March 26 (2:00-3:25) Chairman: R. A. Wilson, Pacific Steel Casting Co., Berkeley; Co-Chairman: J. A. Watson, General Metals Corp., Oakland; Speaker: To be announced.

Iron-Cupola Melting — March 26 (3:30—5:00) Chairman: Robert Gregg, Reliance Regulator Corp., Alhambra; Co-Chairman: A. M. Ondreyco, Vulcan Foundry Company, Oakland; Speaker: Dr. J. T. MacKenzie, American Cast Iron Pipe Co., Birmingham, Ala.

Safety Code for Foundries — March 27 (2:00—2:55) Chairman: E. M. Welch, American Manganese Steel Co., Oakland; Co-Chairman: Charles Hoehn, Jr., Enterprise Engine & Foundry Co., San Francisco; Speakers: H. J. Horswill, Safety Div., State of California; Earl Spitzer, U.S. Dept. of Labor.

Standards, Inspection and Repair of Aircraft Quality Castings—March 27 (3:30—5:00) Chairman: R. A. Johnston, General Metals Corp., Oakland; Co-Chairman: T. E. Caldwell, Asst. Plant Metallurgist, Columbia Steel Co., Pittsburg, Cal.; Speaker: T. E. Piper, Chief Process Engineer, Northrop Aircraft, Inc., Hawthorne, Cal.

R. E. Ward Heads A. F. A. Light Metals Division

R. E. WARD, Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J., is Chairman and A. T. Ruppe, of the corporation's Bendix Products Div., South Bend, is Vice-Chairman of the A.F.A. Aluminum and Magnesium Division. Other executive group members are:

David Basch, representative, Almin Ltd. of Great Britain, Schenectady, N. Y.; Walter Bonsack, National Smelting Co., Cleveland; M. E. Brooks, Dowmetal Foundry, Dow Chemical Co., Bay City, Mich.; Hiram Brown, Solar Aircraft Corp., Des Moines, Iowa; J. C. DeHaven, Battelle Memorial Institute, Columbus, Ohio; J. C. Fox, Doehler-Jarvis Corp., New York; W. E. Martin, National Smelting Co.; C. E. Nelson, Magnesium Div., Dow Chemical Co., Midland, Mich.; H. J. Rowe, Castings Div., Aluminum Co. of America, Pittsburgh, Pa.; A. W. Stolzenburg, Aluminum Co. of America, Detroit, and J. W. Wheeler, Wheeler Consultancy, Springfield, Mass.

Mold Materials Group Starts Working Study

TO DETERMINE what sand property must be controlled to eliminate the "rat tail" surface defect in castings, the Committee on Physical Properties of Iron Molding Materials at Elevated Temperatures, A.F.A. Sand Division, will hold a working meeting at the foundry of the University of Michigan, Ann Arbor, the week of April 7-12, Chairman H. W. Dietert, Harry W. Dietert Co., Detroit has announced.

FOUNDRY DUST

HOODS AND PIPING

E. A. Carsey
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IN PLANNING a well engineered foundry dust control system, the first step is the selection of a properly designed hood, suited to the source of dust. The source of dust is located and the hood placed at that point to reduce the dust concentration to within the limits of hygienic standards.

The second step deals with air volume. This volume determines pipe sizes, actual hood openings and selection of exhaust equipment to produce the desired air flow.

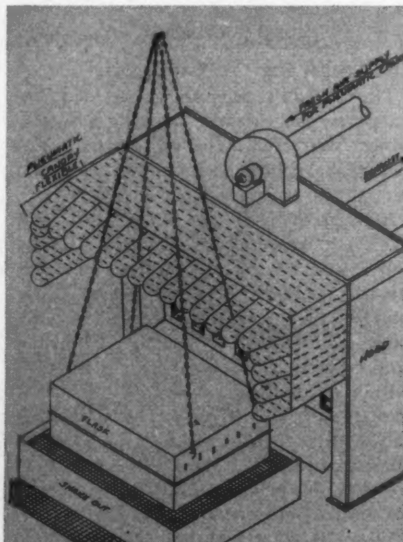
The third step involves details of construction, such as hood and piping gage, proper clearances, and provisions for the safety, comfort and clear vision of the operator. Adherence to American Foundrymen's Association and state codes is checked and, finally, the detailed plan of the system is ready for execution.

Since the crane operator requires a maximum of visibility for unhampered handling of flasks, the use of an overhead hood is sometimes precluded. For this reason, the "side" or "cross-draft" hood usually is considered. The cross-draft hood does not have a roof or full extension over the shakeout grate and, therefore, a much greater volume of air must be handled, resulting in excessive power costs and heat losses.

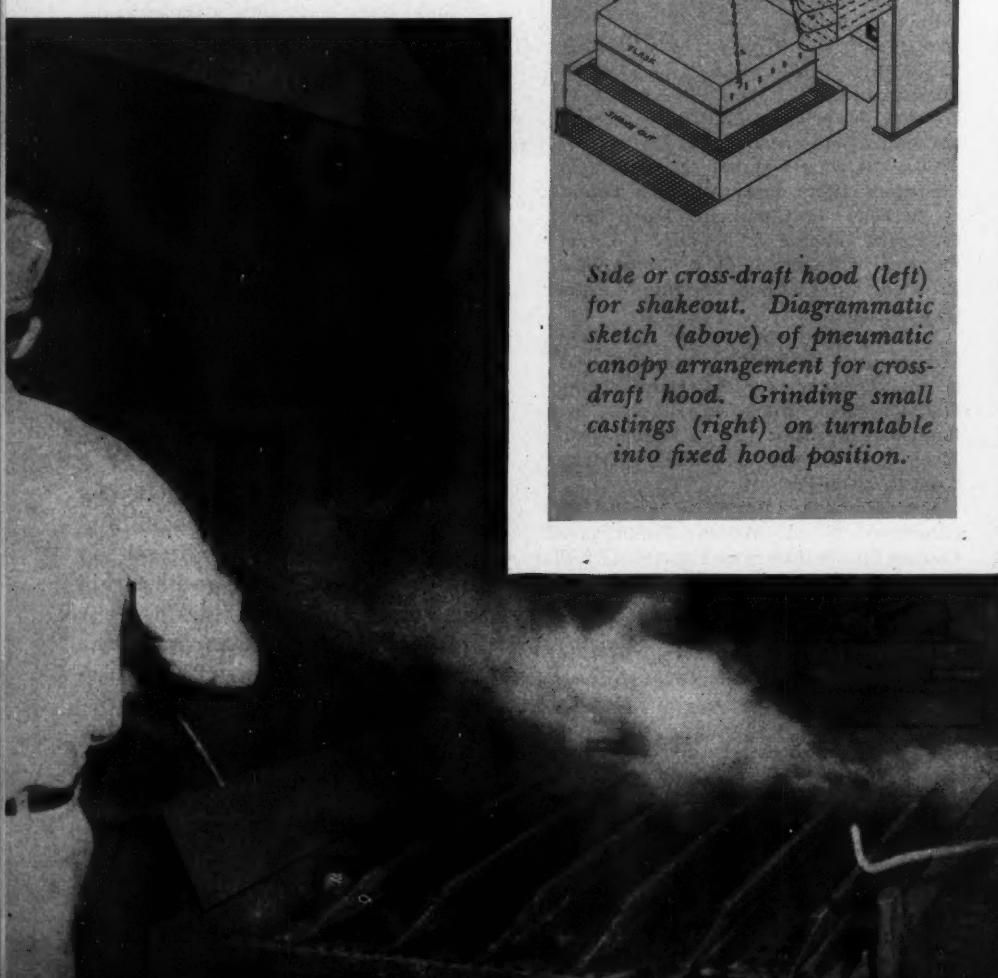
It is well known that velocity contours of controlling air decrease rapidly as the distance from the hood increases. This means that the foundry operator must increase power consumption approximately 100 per cent to operate the cross-draft hood, in comparison to an overhead type or enclosure hood. The solution of this problem could be a compromise between the straight cross-draft hood and the totally enclosed hood.

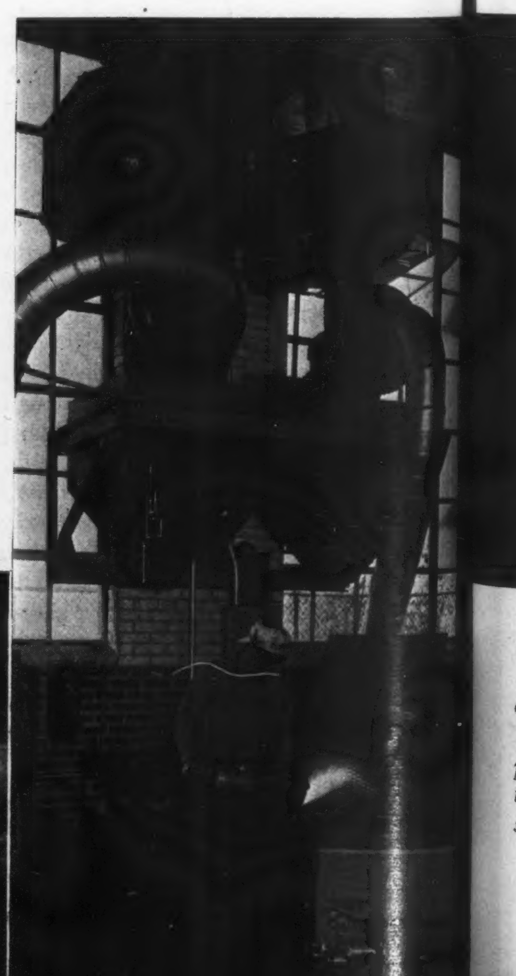
Perhaps this compromise could be accomplished by means of a pneumatic finger canopy arrangement, having rather closely spaced round canvas "fingers" possibly 8 or

(Continued on Page 46)



Side or cross-draft hood (left) for shakeout. Diagrammatic sketch (above) of pneumatic canopy arrangement for cross-draft hood. Grinding small castings (right) on turntable into fixed hood position.





T CONTROL SYSTEMS

MAINTENANCE

Kenneth M. Smith
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EQUIPMENT is no better than the care it receives. The writer says "care" of equipment because maintenance of equipment, as commonly understood, is too frequently undertaken only when the equipment has failed. Routine preventive maintenance or "care" is necessary if undesirable interruptions of service and costly major repairs and replacements are to be avoided.

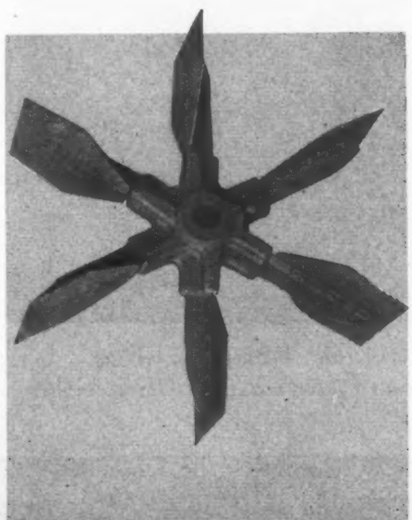
Routine lubrication, cleaning, replacement of worn parts, and general visual checks of all dust control equipment will forestall the major part of equipment breakdowns during production operations. Preventive maintenance pays by eliminating a large part of the losses incurred when workers and equipment cannot be utilized while essential equipment is being repaired.

Foundry dust control starts with the dust hood and ducts. Once a hood and duct system has been properly set up, every effort should be made to keep it in first-class condition. Hood inlet adjustments must be maintained, and dust accumulations must be removed regularly to provide the proper ventilation volume and promote the good housekeeping essential to the modern foundry and advanced practices.

These accumulations in hood entrances and ducts not only cut down the volume of ventilation available, but frequently constitute a dangerous fire hazard, especially where core-oil fumes condense and soak into the dust. Where such fire hazards exist, steam jets for use in smothering a fire should be installed in the duct system ahead of the fan.

Opposed steam jets are necessary to prevent the jet acting as a duct inspirator, as well as to fill all sections of duct with steam as quickly as possible. The stop button for the fan should be installed close by the steam jet valve. The steam jets should be turned on for a few seconds at regular intervals to insure that they will function properly in an emergency.

Liquids which condense in ducts should be continuously drained into containers, which should be emptied frequently. Illustrated in the paper are a duct drain and collecting container for core-oil residues and water from a mold cooling tunnel exhaust duct, and the fan sec-



Typical dust accumulations (above) at mold pouring station exhaust hood. Straight radial blade (top center) centrifugal fan impeller. Drain and collecting container (bottom center) for a condensable fume duct and fan (right).

tion of a similar duct which is badly in need of cleaning. The duct entrance door is in need of a drip deflector on the bottom inside edge.

Frequently, dust control hoods are severely abused and rendered useless, especially at shakeouts. Hood face parts must be rugged. Where experience shows that hoods will be abused, they should be constructed of heavy materials. Hoods on grinders should be kept clean and in first-class repair for safety and control.

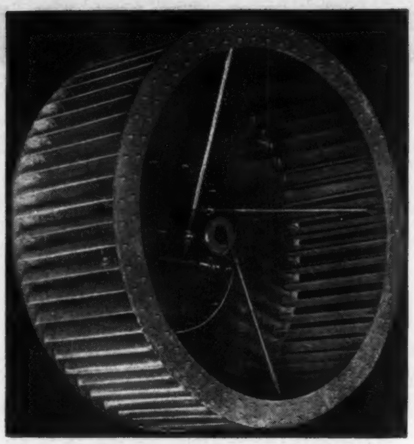
When long horizontal ducts are used to convey dust-laden air to a collector, they should be made in flanged sections bolted together to permit turning the duct to a new position several times during the life of the duct. Otherwise, the abrasive wear on the bottom of the duct will cause premature duct failure. Bolted flanged elbows in abrasive dust systems are useful for expediting elbow replacement.

Maintenance and Design

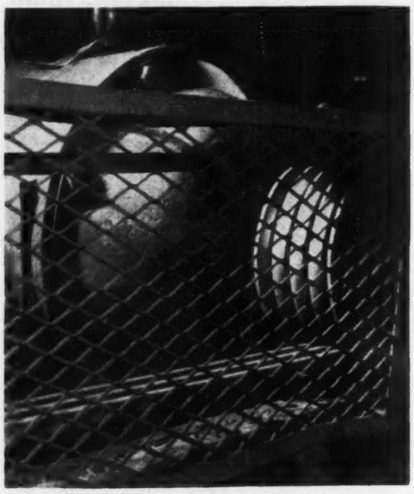
Since the maintenance necessary on a fan is frequently determined by its design, the proper fan for the dust and fumes to be handled must be chosen with care. For exhaust systems on mold pouring and cooling stations, core ovens, or any system handling condensable fumes, radial blade centrifugal fans will give the most satisfactory results since they are relatively self-cleaning by centrifugal force. Examples of a straight radial blade centrifugal fan impeller in contrast to the multiblade type of fan impeller are shown in the accompanying illustrations.

If a multiblade type of fan gives continual trouble from dust build-up and consequent vibration, it should be replaced by a fan of the radial blade type. The photograph shows a multiblade type fan impeller on a large mold break-apart exhaust system. Regular cleaning of the fan impeller is necessary for proper operation. Cleaning and checking of such fans can be done more easily if a section of the fan scroll sheet is made removable. Suitable sealing strips must be provided on the edges of the section.

When vibration is detected in a centrifugal fan, it should be checked for worn or missing impeller blades



Multiblade type centrifugal fan impeller on a mold exhaust hood.



Multiple V-belt fan drive. Note one of four drive belts is missing.

and for material accumulations on the impeller. Material accumulations should be removed and necessary repairs made. Rebuilt fan impellers should be carefully balanced.

On dust and fume control systems where the dust is not collected, propeller-type fans are frequently used. When they are used to handle condensable fumes, they should be of the narrow streamline blade type to cut down the blade area which may collect dirt. Even so, they should be cleaned regularly. Convenient access doors should be provided in the ducts to permit of easy cleaning and changing of fan blades.

Belts on external drive duct fans must be kept tight and the bearings well lubricated, especially in ducts from mold pouring exhaust hoods which may carry hot gases. Also, they should be equipped with an easily adjusted belt tightener. The drives for centrifugal fans which use multiple V-belts are often abused. Frequently, the individual loose or broken V-belt is not replaced until the overload has damaged the remaining belts.

Where abrasive dusts may be encountered, the propeller blades must be checked and changed periodically to insure efficient fan performance. Illustrated are typical worn propeller blades which should be changed in order to insure efficient ventilation. Note the maintenance man's

Worn propeller blades on fan handling air containing abrasive dust.

quick method of obtaining an adequate door for fan blade change.

Several types of dust collectors are used in the foundry, each presenting separate maintenance problems. Where there are no condensable fumes, high temperatures or gummy materials present, the cloth-type collector is commonly used.

Both the tube and the envelope-type bag will eventually increase in resistance from the accumulation of lint in the cloth pores. This lint often comes from grinders' gloves and from paper used to clean safety glasses. When the cloth resistance increases sharply, the bags should be replaced. Otherwise, the ventilation volume drops and the rapping devices wear holes in the bags, thus permitting abrasive dust to reach and damage the fan.

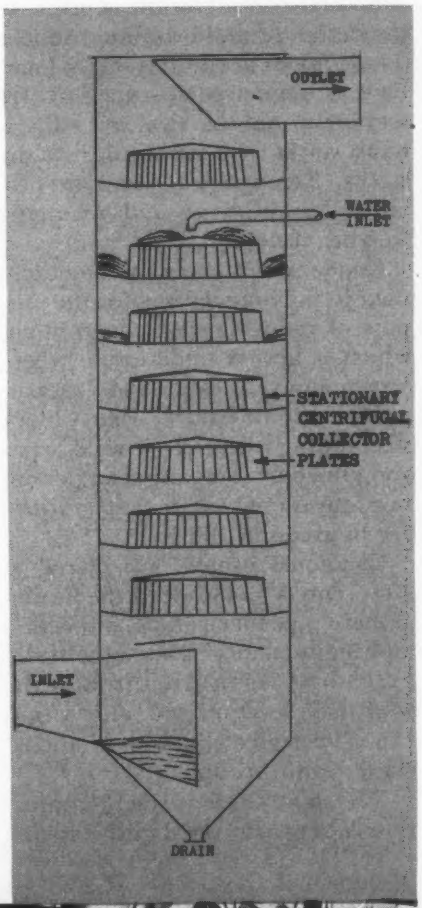
Rapping devices should be kept in good order to keep the collector bags in full use. Cloth collectors should be shaken down at regular intervals, such as lunch hours and shift changes. The collected material hoppers should be emptied regularly to prevent unnecessary dust recirculation against the cloth sacks. The air inlet must be kept baffled to prevent the air stream from impinging directly upon the sacks.

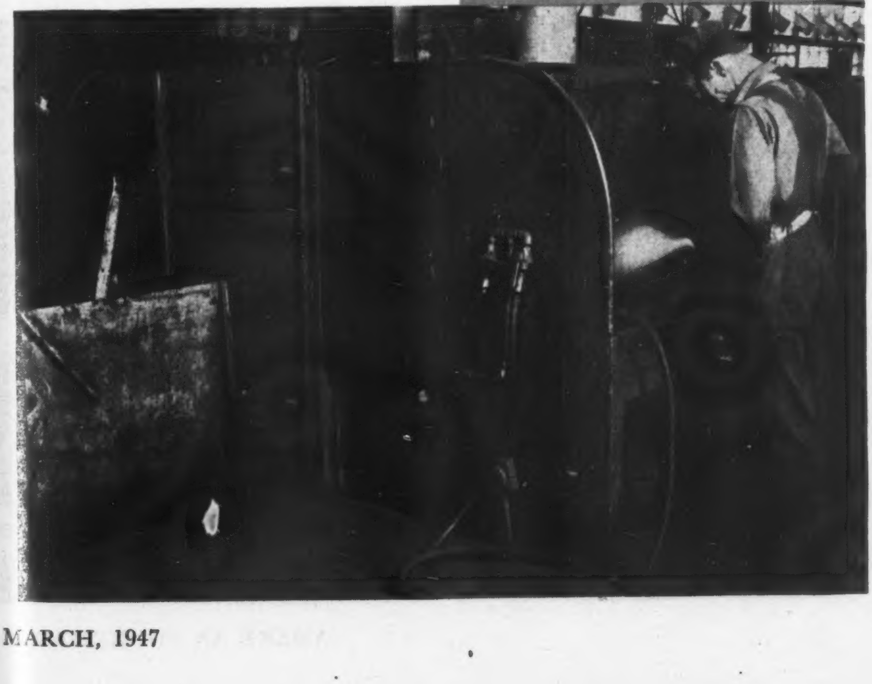
The rotary centrifugal type of collector combines collector and fan functions. Under light dust loads it will operate for long periods with only routine lubrication and general inspection. For heavy abrasive dust loads the rotary centrifugal fan collector should be provided with liners in the dust collecting ring.

These liners should be checked periodically to prevent excessive damage to the main collector housing in case the liners wear through. By the time a set of liners has worn through, the fan impeller probably will need reblading. Prompt reblading service is provided by equipment manufacturers.

For heavy dust concentrations, a precleaner arrangement reduces the wear on the fan impeller and housing. The dust hopper for the rotary centrifugal collector should prevent any recirculation of the dust. The hopper should be emptied frequently. Several wet type dust collector arrangements are available for foundry use. Their basic principle of operation is to mix the dust-laden air with a water fog or spray in order to wash the air. Some form of moisture elimination is then employed to separate the water and dust mixture from the air stream. If rotary impellers are used, the impellers must be kept clean to prevent vibration. If baffles only are used, they should be checked periodically and any build-up removed.

Eliminators must be kept in good order to prevent extra carryover to the fan, which may get out of balance from solids built up on the impeller. Where a mechanical sludge conveyor is used, the conveyor will require routine checking and occasional repair and replacement. Core-oil fumes should not be put through a wet type rotary centrifugal collector. The fumes condense on the fan impeller, where they collect dust and destroy impeller balance.





Down-draft grinding bench and sketch of multistage wet collector.

Wet Type Collector

Where a series of vertical centrifugal collector sections is used in a wet collector, adequate clean water must be passed through the collector to keep it flushed clean. If the water must be recirculated, adequate settling tanks or basins must be provided to prevent sludge deposits in the collector sections. Sludge in the water also plugs the water lines and the drain and damages the circulating pump. Sludge also tends to collect at the collector inlet, as illustrated, and must be removed from both the collector sections and inlet at regular intervals. With an adequate supply of clean water, this cleaning problem will be reduced to occasional cleaning of the inlet.

A grinding bench equipped with six sectional type air filters serves to illustrate maintenance on this type of dust collector. The filters are removed every second day, cleaned in oleum, sprayed with SAE 10 lubricating oil and reinstalled. This maintenance is done on the night shift when benches are not in use, but with a spare set of filters it could be done at any time.

HOODS AND PIPING

(CONTINUED FROM PAGE 42)

10 in. in diameter. They would be held in a horizontal position over the grate by means of a small supply blower mounted alongside, or on top of the shakeout hood. The space between tubes or fingers would afford a clear view to the crane operator, and the chains would slide and work their way between the tubes with little or no difficulty.

Such a design would save 50 to 75 per cent of power costs, in comparison to the straight shakeout crossdraft hood. This is a typical example of the specialized design possible in foundry hoods, which is so important as "step one" in dust control.

Foundry snagging and cleaning departments offer another opportunity to improve hood design. Here it is possible to apply pedal-operated turntables, built to a convenient height so that smaller castings are turned and the operator grinds into a fixed hood position. Of course, if the castings are larger the cylindrical type downdraft arrangement is preferred.

If floor gratings are used, movable vertical screens or baffles are of assistance in directing the light grinding dust downward. The conveyor transfer points, elevator boot and head connections, shaker screens, mixers, mills, aerators, tailings hoppers, tunnels and the like usually can be handled with direct rectangular to round hooded connections.

Individual grinding stands or groups of wheels are served by heavy-duty plate hoods, some with traps built immediately below the intake and others with traps in the vertical exhaust to the rear of the stands. Foot rests sometimes are incorporated into design, and sides and tops are hinged for wheel replacement or dressing.

A large individual grinding wheel, either vertical or horizontal, provides an interesting problem. It is advisable to consider wheel replacement and location of the point of exhaust as closely as possible aligned with material leaving tangent to the periphery of the wheel. Sometimes on larger wheels the complete top half of the hood is removable for wheel replacement.

The horizontal grinder frequently has its own exhaust connections built in the bottom. It is then necessary only to utilize a circular header at the bottom of the grinder to collect the various points of exhaust.

Special consideration is given to the design of mold cooling tunnels. These hoods are built from the floor, have a semicircular top and are served by one or two vertical exhaust stacks with fans built into the stacks. Removable sections are provided for applying and removing weights, if desired.

Condensation traps are sometimes used in the branch lines for the purpose of reducing moisture content, which is always undesirable where accompanied by solids and dust particles in the air stream. Heavy black steel piping with electric-weld seams and joined by companion angle connections is used where temperatures are in excess of 400 F.

Cleanouts usually are placed at 10-ft centers alongside of the header or main pipe for cleaning, inspection and maintenance. Discharge stacks extending vertically through the roof may be equipped with a rain cap, a 90-degree elbow, or a tapered static regain section.

The most efficient stack termination is, of course, the slightly tapered regain nozzle, which converts some of the velocity pressure back into static. The rain cap and elbow offer some protection against weather but create a slight additional back pressure to air discharge.

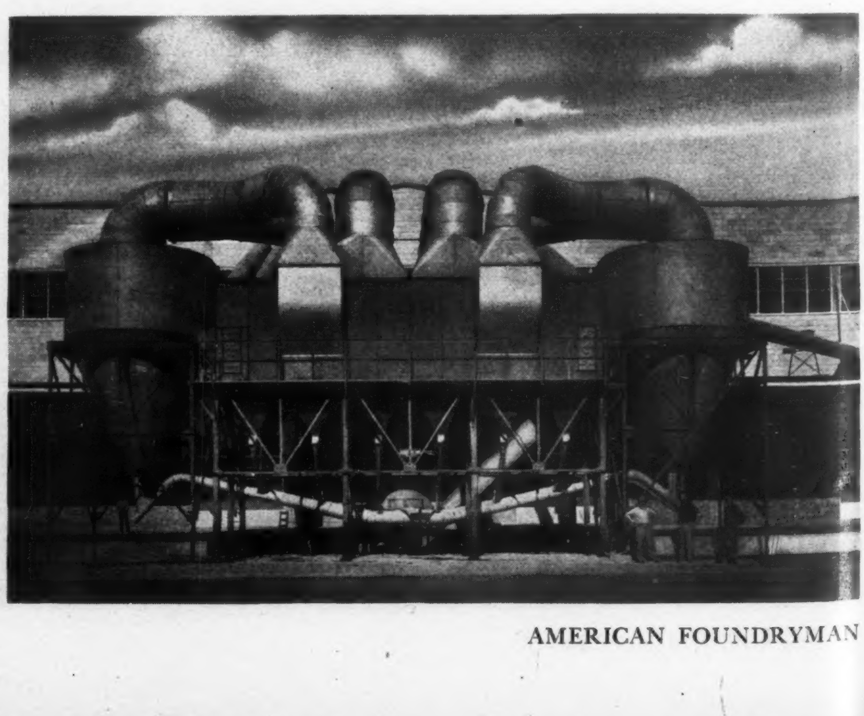
The foundry pattern shop also has its dust control problem. However, in this case the materials involved are woodworking shavings, chips and sawdust rather than foundry abrasives. The hoods and piping can be somewhat lighter in gage but, nevertheless, require careful planning and expert fitting to the woodworking machines.

In most instances, in the foundry proper, space being at a premium, the hood equipment and piping from the hoods must be built into extremely limited space. This leads into steps two and three, or the important phase of determining air volume and piping size.

Pipe Design Important

Not until recent years has the problem of pipe design been given its just place of importance in modern foundry dust control systems. Periodically, it is again discovered that piping plays a major role in good foundry practice and, although the design and ideas are somewhat different and slightly more advanced in the last quarter century, the basic principles are the same.

Fittings and connections are used with branches brought in at gradual angles and elbows provided with throat radii, resulting in a minimum of friction loss to air and material flow. Since the maximum amount



Dust control piping terminal of large combination collection unit.

of wear in an elbow takes place at the heel (the side opposite the throat), removable plates are provided which receive the wear of the abrasive materials handled in the air stream. These plates are replaceable, making it unnecessary to change the elbow itself.

The heavy-duty "one-piece" elbow usually is seen in modern installations. This elbow, by virtue of being formed from one piece of sheet metal, has but one throat seam and no rivets to wear. The girth seams are formed from the metal itself, providing three thicknesses of metal seam completely around the elbow at each crimp.

The majority of foundry piping installations make use of galvanized iron or steel, with riveted and soldered longitudinal and circumferential seams. Gages of piping range from No. 18 gage for small-diameter pipes through No. 14 gage for larger sizes. Elbows are at least two gages heavier. Old dust control systems may often be modernized by rearranging, balancing and replacing the piping.

Velocity Pressures

Determination of piping diameters is a study in itself. Present-day foundry piping design is customarily based on velocities ranging from 3600 to 4500 fpm, or velocity pressures from 0.8 through 1.3 in. of water. It is desirable to maintain as constant a velocity pressure as possible, and cut-offs sometimes are provided and locked in a fixed position to accomplish this.

Computation of losses in the entire piping system must be carefully worked out, and a study of hood entrance losses with equivalent loss in percentage of velocity pressure, plus lineal friction loss of pipe in static, branch and elbow losses, plus pressure drop across pre-cleaning and exhausting equipment, determines the total pressure at which the systems should operate.

Round piping usually is preferred to oval or elliptical shapes. Since the static pressures are quite high in material-handling systems, rectangular and square ducts, if used, must necessarily be well braced to prevent vibration. Finally, caution should be exercised in the sizing of pipe, as the use of smaller sizes for velocities above 4500 fpm will result in increased power consumption.

COMMITTEE APPOINTMENTS
Made by A. F .A. Technical Divisions

A.F.A. DIVISION CHAIRMEN have announced appointments to a number of Association committees. The Chairmen, their Divisions and the appointments, follow.

D. FRANK O'CONNOR, American Saw Mill Machinery Co., Hackettstown, N.J., and Chairman, A.F.A. Brass and Bronze Division: *Executive Committee,* D. Frank O'Connor, Chairman; W. W. Edens, Ampco Metal, Inc., Milwaukee, Vice-Chairman; J. E. Foster, A.F.A. Staff, Secretary; W. M. Ball, Jr., Magnus Brass Div., National Lead Co., Cincinnati; W. B. George, R. Lavin & Sons, Inc., Chicago; E. W. Horlebein, Gibson & Kirk Co., Baltimore, Md.; Blake M. Loring, U. S. Naval Research Laboratory, Washington, D.C.; B. A. Miller, Cramp Brass & Iron Foundries Div., Baldwin Locomotive Works, Philadelphia; H. M. St. John, Crane Co., Chicago.

Program and Papers Committee, W. W. Edens, Chairman; G. P. Halliwell, H. Kramer & Co., Chicago, Vice-Chairman; Dr. R. M. Brick, University of Pennsylvania, Philadelphia; J. F. Ednie, Duquesne Smelting Corp., Pittsburgh, Pa., G. K. Eggleston, Barnes Mfg. Co., Mansfield, Ohio; A. H. Hesse, R. Lavin & Sons, Inc.; R. W. Parsons, Ohio Brass Co., Mansfield, Ohio.

Research Committee, Blake M. Loring, Chairman; G. P. Halliwell; Dr. R. M. Brick; C. A. Robeck, Gibson & Kirk Co., Baltimore; Dr. A. J. Smith, Lunkeheimer Co., Cincinnati.

DR. H. RIES, Ithaca, N.Y., and Chairman, A.F.A. Sand Division: *Grading and Fineness Committee,* R. E. Morey, Naval Research Laboratory, Chairman; H. J. Williams, New Jersey Silica Sand Co., Millville, N.J., Vice-Chairman; B. H. Booth, Carpenter Bros., Milwaukee, Secretary; Stanton Walker, National Industrial Sand Association, Washington, D.C.; A. I. Krynitsky, National Bureau of Standards, Washington, D.C.; E. C. Zirzow, National Malleable & Steel Castings Co., Cleveland.

Mold Surface Committee, J. B. Caine, Sawbrook Steel Castings Co., Cincinnati, Chairman; J. A. Rassenfoss, American Steel Foundries, East Chicago, Ind., Secretary; F. S. Brewster, Dowmetal Foundry, Dow Chemical Co., Bay City, Mich.; H. W. Dietert, Harry W. Dietert Co., Detroit; K. J. Jacobson, Griffin Wheel Co., Chicago; H. M. Kraner, Bethlehem Steel Co., Bethlehem, Pa.; L. B. Osborn, Hougland & Hardy, Inc., Evansville, Ind.; E. C. Troy, Dodge Steel Co., Philadelphia.

Flowability Committee, P. E. Kyle, Cornell University, Ithaca, N.Y., Chairman; W. G. Parker, Elmira Foundry Co., Elmira, N.Y., Vice-Chairman; H. W. Dietert; N. H. Keyser, Battelle Memorial Institute, Columbus, Ohio; D. F. Sawtelle, Malleable Iron Fittings Co., Branford, Conn.

F. G. SEFING, International Nickel Co., New York, and Chairman, A.F.A. Educational Division: *Foreman Training Subcommittee, Industrial Training Committee,* S. G. Garry, Caterpillar Tractor Co., Peoria, Ill., Chairman; W. F. Graden, Simonds Abrasive Co., Philadelphia, Vice-Chairman; G. J. Leroux, National Malleable & Steel Castings Co., Secretary; W. E. George, Booz, Allen & Hamilton, Chicago; D. F. Lane, Bethlehem Steel Co., Sparrows Point, Md.; A. C. Ziebell, University Foundry Co., Oshkosh, Wis.

V. J. SEDLON, Master Pattern Co., Cleveland, and Chairman, A.F.A. Pattern Division: *Program and Papers Committee,* A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee, Chairman; H. K. Swanson, Swanson Pattern & Model Works, East Chicago, Ind., Vice-Chairman; J. W. Costello, American Hoist & Derrick Co., St. Paul, Minn.; F. H. Goodwin, Goodwin-Bradley Pattern Co., Providence, R. I.; H. E. Lees, Whitin Machine Works, Whitinsville, Mass.; G. E. Pealer, Elmira Foundry Co.; E. Pierie, Motor Pattern Co., Cleveland; Martin Rintz, Continental Foundry & Machine Co., East Chicago, Ind.; W. G. Schuller, Caterpillar Tractor Co.; A. H. Stenzel, Stenzel Pattern Works, Houston, Tex.

Michigan Foundries

WELCOME VISITORS

Inspection Trips Planned During A.F.A. Convention; Motor City Modernization Programs Are Impressive

ONE OF THE HIGHLIGHTS of the 51st annual convention of the American Foundrymen's Association in Detroit will be the extensive plant visitation program now being arranged by committees of the A.F.A. Detroit chapter.

Detroit stands at the heart of one of the world's largest industrial empires. Here mass production and the assembly line are symbols; and here millions of castings of varied type and description are turned out annually. Foundries located in Detroit and the surrounding area range from the small jobbing specialists to the modernly mechanized production shops serving the automobile and other industries and many of these plants will hang out the welcome sign for A.F.A. visitors, next month.

This means that foundrymen considering mechanization as the answer to many of today's problems will have the opportunity, during their stay in Detroit, to observe some of the nation's newest and most elaborate production and conveying systems in action. They will learn first-hand how, in the face of many obstacles, foundrymen are bringing their plants to new levels of mechanized efficiency, driving out old "bugs," improving quality and increasing production.

Post-war modernization in foundries of the Ford Motor Co., Packard Motor Car Co. and units of General Motors in Detroit has been delayed by reconversion difficulties but will be near enough to completion late in April to afford observers an adequate conception of the principles involved.

In the Cadillac foundry, for example, A.F.A. members and guests will view a fully mechanized system, including a new overhead control furnace which retards the cooling of motor blocks after they are shaken from the molds.

The Cadillac Motor Car Division of General Motors Corporation and the Packard Motor Car Company in Detroit will throw their foundries and car assembly lines open for the inspection of A.F.A. members and the Plant Visitation Committee of the Detroit chapter will assist in transportation arrangements for those wishing to avail themselves of the invitation.

In the huge Ford foundry the revitalized system of continuous cylinder block casting is operating smoothly. This system is unique in that two 400-ton capacity mixers are used to feed four continuous cylinder block casting lines. Molten metal from the blast furnace is blended with metal from the cupolas in these mixers.

This 400 ton mixer unit in the Ford Motor Company foundry is used to store hot metal as well as mix molten iron from the blast furnaces with metal from the cylinder block cupolas. Hot metal is poured from the giant brick-lined mixers into transfer cars (at left in picture) which take the metal to adjoining electric furnaces for pre-heating.

Hot metal is poured from a pouring car into cylinder block molds traveling along a continuous casting line in the Ford Motor Co. foundry.

Nearly a million automotive and tractor parts can be cast in the Ford foundry in 24 hours. At peak production its furnaces melt 4,000,000 pounds of gray iron and steel daily, supplying metal for 5,400 engine blocks and other castings. Molds travel along a conveyor line two miles long in moving to the centrally located pouring stations. The Ford foundry is said to be the first to use conveyors for moving molds to the metal instead of bringing the metal to the molds.

Ford's handling of cores is also unique. More than 46 cores go into the final mold used in casting the V-8 cylinder block and a large new core room has been added to the previous five serving the plant.

The four units for producing motor cylinder blocks have been rebuilt and new dust collector systems have been installed as part of the modernization program.

Other foundry improvements include: installation of a sand reclaiming system; building of a new layout for grinding and chipping motor blocks; erection of a new cylinder shot blast cleaning system; enlargement and consolidation of the heat treat department; building of an improved system for casting intake and exhaust valves, and erection of a new cylinder block welding department.

Two committees have been named by the Detroit Chapter to arrange plant visits—the "Ford Day" Committee, headed by R. H. McCarroll of the Ford Motor Company, and the Plant Visitation Committee of which H. M. Bringhurst, of the Semet-Solvay Company, is Chairman.

The "Ford Day" visit is scheduled for May 2, at the close of the 51st Annual Convention. Mr. McCarroll has announced that the Ford Company will make buses available for transportation of A.F.A. members and guests to the Ford plants. If a large registration for the "Ford Day" tour is realized, both morning and afternoon visits will be arranged. Foundrymen will be escorted to the Rouge plant for a brief inspection before visiting the adjoining Ford foundries.

Mr. McCarroll, nominee for A.F.A. director, will be present to receive the visitors. Other members of the "Ford" committee include E. Claude Jeter, Gosta Vennerholm, R. W. Green and Jack Mullaly, all of the Ford Motor Co.

Other Detroit foundries which will have the latch-string out for A.F.A. members and guests are:

Detroit Gray Iron Foundry Co.—General jobbing work.

Central Iron Foundry—Heavy gray iron jobbing work.

Riley Stoker Corp.—Gray iron duplexing with electric furnaces.

American Car & Foundry Co.—Molding and machining of lubricated valves.

Atlas Foundry Co.—General jobbing—Meehanite.

Motor & Machinery Castings Co.—Gray Iron jobbing foundry.

U. S. Radiator Corp.—Large sectional heating boilers.

Kelsey Hayes Wheel Co.—Centrifugal castings of brake drums.

Detroit Steel Castings Co.—New installation of two electric furnaces.

Michigan Steel Casting Co.—Precision castings.

Federal Mogul Corp.—Bronze foundry and machine shop.

Sherwood Brass Works—Mechanized foundry.

Nationally known plants near Detroit, which have also declared "open house" for A.F.A. members during the convention period, are the Buick Motor Car Div., General Motors Corp., Flint, Mich.; the Saginaw Malleable Iron plant, General Motors Corp., Saginaw, Mich., and the Wilson Foundry & Machine Co., Pontiac, Mich.

Pouring molten pig iron from blast furnaces into an open hearth.

"FORD DAY" REGISTRATION

Members and guests planning to visit the Ford Motor Co. foundry in Detroit, May 2, are urged to fill out and return the registration card appearing in this issue. Because return cards cannot be provided outside the United States, visitors from Canada, Mexico and abroad are requested to make known their desire to visit the Ford factory by communicating direct with the A.F.A. 222 W. Adams St., Chicago 6.

QUALITY CONTROL METHODS

Quality "cannot be inspected into castings." Basic principles of directional solidification, in conjunction with metallurgical and foundry processing, must be understood. Close collaboration of designer and foundryman, with a mutual understanding of all requirements, results in a quality product through properly coordinated process controls. Interpretation of acceptable standards of steel casting quality is of utmost importance. Service requirements of the casting should be thoroughly understood, and specifications properly written for the grade or quality needed. Acceptable standards should be clearly defined and mutually agreed upon before job production.

J. W. Juppenlatz
Chief Metallurgist
Lebanon Steel Foundry
Lebanon, Penna.

Quality control, when applied to castings, means that the character and over-all properties are consistently and uniformly maintained from casting to casting according to predetermined standards. Before quality and its control can be properly understood, the level of quality required must be established as dictated by the intended service application.

Quality levels of castings are constantly changing and, with the passing years, improvement of foundry processes has resulted in the production of castings approaching perfection. Methods of checking the individual casting for the level of quality have been refined, and more exacting methods of inspection developed.

The foundry, with its diversified products for various service applications, must have standard levels of quality adjustable to each type of service application. While a higher level of quality than chosen would be satisfactory for purely economic reasons, the highest quality level may not be required. Therefore, a satisfactory quality level for each casting design should be established according to satisfactory service performance so that production castings can be compared to definitely fixed standards of acceptance.

Qualities of castings involve Chemical, metallurgical, physical and soundness properties. Since the major portion of service failures is attributable to unsoundness, such as surface and subsurface defects, this

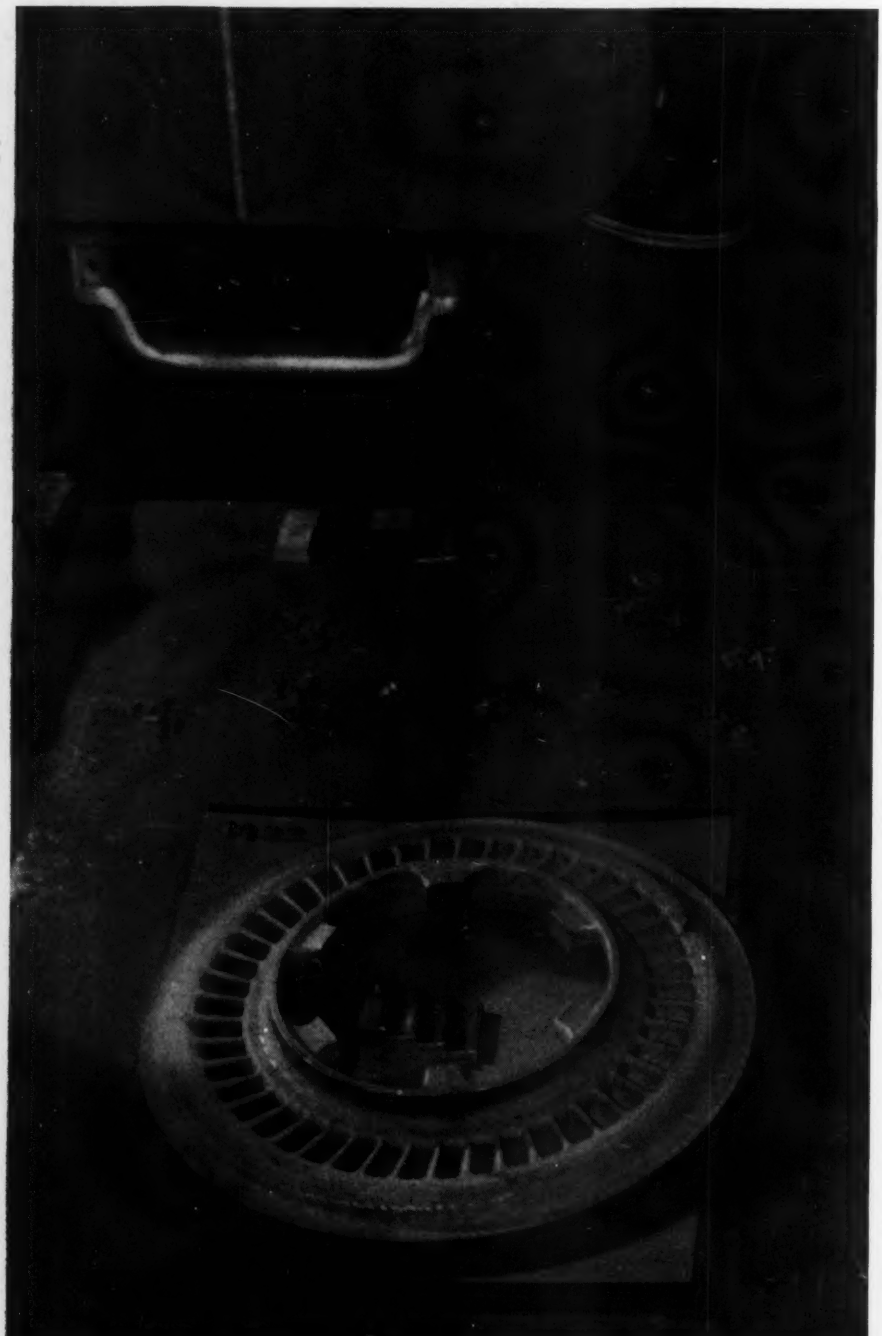


Fig. 1—250-kv x-ray machine being used for examination of austenitic alloy supercharger casting. This is an example of production work subject to 100 per cent radiographic inspection. Practical section limitation is $1\frac{1}{2}$-in. thickness.

discussion is aimed to cover applicable methods to determine qualities of casting soundless and requisites to promote their production. Illustrations in the paper pertain to steel casting production, but the scope may include other types of castings.

Records show that quality control of steel castings for railroad use started many years ago. Regular production castings were subjected to severe overloads and often tested to complete destruction. These tests afforded the engineer and steel foundryman fundamental information as to the quality of the casting, the effect of variable degrees of external and internal defects, as well as valuable design data. With these test results, coupled with actual service records, standards of acceptance for railroad steel castings were formed and now are well understood.

Service Performance

Many railroad castings are in service today after 35 years of satisfactory performance, yet these castings may contain surface and internal defects of varying proportions. These defects are not considered injurious, whereas similar defects in a highly stressed airplane landing gear, for example, could not be permitted.

When the highest level of casting quality and uniformity is desired, the production of such parts requires: (1) strict adherence to design principles for directional solidification; (2) exacting process controls for manufacture; (3) nondestructive inspection for the standard of quality required.

The highest standards for casting quality require more confining and exact process controls of each operation, since the quality must be engineered into the casting and cannot be derived by inspection means alone. In order to be assured of the high quality desired, certain extra or special methods of inspection are involved, such as radiography, magnetic particle surveys, or other searching nondestructive tests for hidden discontinuities of the minutest nature.

Naturally, these special operations add appreciably to the cost of the manufacturing process and, since economic considerations cannot be neglected, the desired quality level must be carefully selected with that factor in mind.

Repair Welding

Steel castings, like steel ingots, are subject to surface and internal defects. These defects must be found and removed when required but, unlike billets or blooms, must also be filled in by proper repair welding. Satisfactory repair welding can be accomplished with rods capable of producing comparable physical properties after final heat treatment of the castings.

Failure to observe the proper foundry control and design requirements leads to defects such as refractory or mold sand defects, internal shrinkage, cracks and tears, gas porosity, slag, etc.

Inspection for quality several years ago depended largely upon visual examination alone. Other tests for soundness were destructive and, obviously, were not used on production castings. Visual examination still remains an effective means of quality inspection for commercial grades of steel castings; however, when the requirements

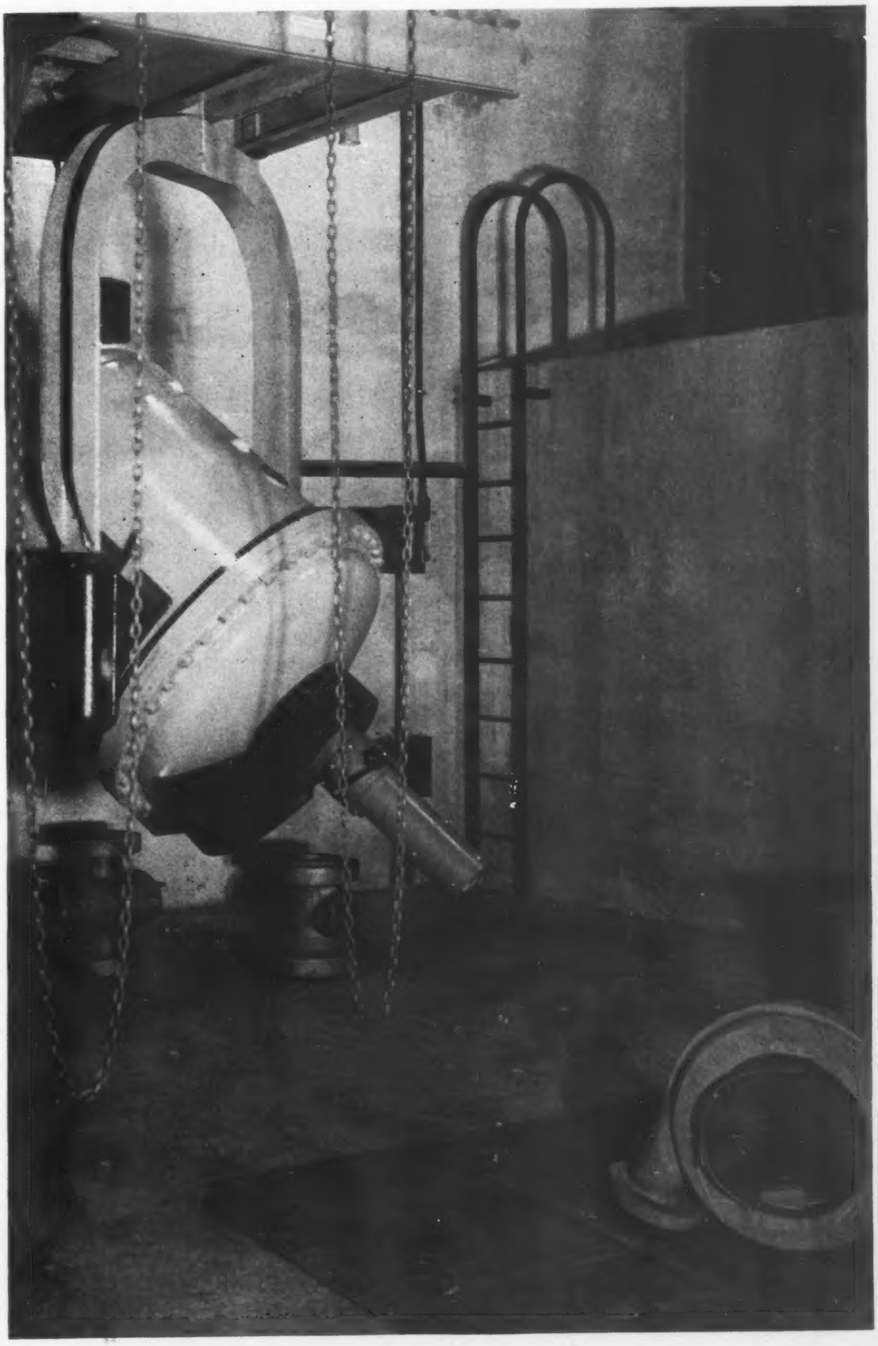


Fig. 2—1000-kv x-ray machine being adjusted prior to exposure. Practical section limitation is about 6-in.

become more exacting, other methods of inspection are employed.

Radiography is the most common and presently accepted method of non-destructive testing (Figs. 1 and 2). Details of procedure need not be included here since excellent technical articles are available.[1] Since 1926, when some of the first high pressure cast steel fittings were x-rayed, gamma-ray (radium) techniques (Fig. 3) have been developed for the heavy sections of castings involved. The cost of films and the operating expense has limited this mode of inspection to critical castings.

Testing Pilot Castings

Recently, radiography has been accepted by many foundries as a working tool for the complete exploration of all pilot castings before entering production. With such practice on pilot castings, the foundry can explore for internal shrinkage or other defects and may improve methods or make design changes to overcome these difficulties before production is started.

This method of procedure has definitely raised the general quality level that may be expected from steel castings, since properly controlled repetitive methods should yield equally sound castings without the expense of 100 per cent radiographic inspection.

Radiographic working standards with proper interpretation are essential and must be clearly understood by both the foundry and casting user. Incomplete knowledge or lack of workable standards for acceptance may defeat the useful purpose of this test.

Power Ratings

X-ray machines as used for casting inspection have increased in power ratings, thereby decreasing time of exposure and increasing sensitivity and applicable thickness ranges. Two-million volt x-ray machines are now in operation on heavier sections of castings, resulting in radiographs with greater sensitivity. The 20-million volt betatron has been announced as capable of penetrating about 18 in. of steel with considerable sensitivity and latitude.

With these newer methods and improvement of technique, radiographs proper are now being produced at a higher level of quality. Casting defects are more clearly defined with less general fogging and, if compared with acceptable standards produced under the older methods, allowance should be made for the increased degree of sensitivity attributable to the improvement in the radiographic technique alone.

With these improvements of process and technique for superior sensitivity of defects, complete new sets of radiographic standards pertaining to each method of radiography should be made available to the foundry.

Stereoscopy, i.e., three-dimensional radiography, promises to be of aid to the foundryman by locating defects normally disclosed by radiographs. This is done by two separate radiographs of the same casting with a focal spot movement of known quantity. Then, by calculation with distances and other factors, and the aid of a stereoscope, the location of the defect can be determined. Sharply defined x-rays permit accurate determinations of size and position of the casting defect.

Magnetic Particle Test

Within the past decade the magnetic particle test has gained prominence as an inspection method applicable to magnetic types of castings. The American Society for Testing Materials has adopted a tentative standard [2] for this method, and several technical articles are available.

The magnetic particle test is primarily limited to surface defects. When the proper flux density is applied with a subsequent magnetic powder application, surface discontinuities are quickly indicated by a buildup of the magnetic powder. A casting may be completely surveyed at a lower over-all cost than is possible with radiography.

In some instances, sensitivity of the magnetic particle test is greater than radiography due to the plane of the defect, which generally is at right angles to the surface. Small cracks of only a few thousandths of an inch in depth are revealed. These the average x-ray test would not disclose. Of course, defects of this nature normally are not discernable on visual inspection.

The magnetic particle test, on the other hand, has not proved to be of any particular value in disclosing internal defects and, therefore, does not replace radiography but rather supplements it. The magnetic particle test usually is applied only to the higher types of quality castings (Fig. 4), where service requirements justify the added expense.

Fluorescent-Penetrant Inspection

Fluorescent inspection is now being applied to both non-magnetic and magnetic types of cast materials. This method is useful only for the determination of surface defects. Internal defects are not disclosed; therefore, the end result of this method is similar to the magnetic particle test. The equipment required is not extensive, nor is any part of the operation difficult.

The casting to be inspected is immersed in, or sprayed with, a prepared highly fluorescent, light, water soluble, penetrating oil. After approximately a 10-min. soaking period, the oil is allowed to drain from the casting and the excess oil on the surface is washed away with warm water.

After drying, the casting is ready for examination in a darkened room under a violet-ray light (black lamp), with or without a developing powder dusted over the surface. Any surface defects then appear to fluoresce with a degree of brilliance in accordance with size and direction (Fig. 5).

Supersonic testing, while a comparatively new method, is now being used for the inspection of castings. The instrument (Fig. 6) sends supersonic vibrations through the casting under test, and measures the length of time it takes these vibrations to penetrate the material, reflect from the opposite side, or an internal defect, and return to the sending point. An oscilloscope pattern is produced on the screen, providing a visual indication of any defects which may be present in the material under test (Figs. 7).

Supersonic testing is limited to relatively smooth, flat surfaces providing good contact for the search-

ing unit crystal. Sand-cast surfaces are too rough and require hand grinding. The method is not yet applicable with uneven and curved surfaces.

There appears to be no limitation as to section thickness for the foundryman, as sections up to 15 ft have been successfully penetrated with a good degree of sensitivity. Small, irregularly shaped castings with thin-wall sections are frequently difficult to test supersonically if they do not provide suitable surfaces from which the beam can be projected into the body of the casting at right angles to the available testing surface.

The minimum wall section is of about ½-in. thickness. Testing of thinner sections is sometimes practical when the sound vibrations can be passed through the flat edge, which actually represents a much heavier section (width).

Metals should be dense and with a cast grain of reasonable size. Austenitic alloy castings with large crystal size and variable crystal orientation cannot be penetrated, which probably is due to sound vibrations from the crystalline grain boundaries.

Sensitivity of the present equipment appears to be adequate for the exploration of castings. It is reported that defects in regular steel can be detected if the defect size is 0.1 per cent of the distance from the testing surface. At a distance of 5 in., a defect of 0.005-in. thickness should be easily detected.

Records of defects are not recorded, as all images are visually

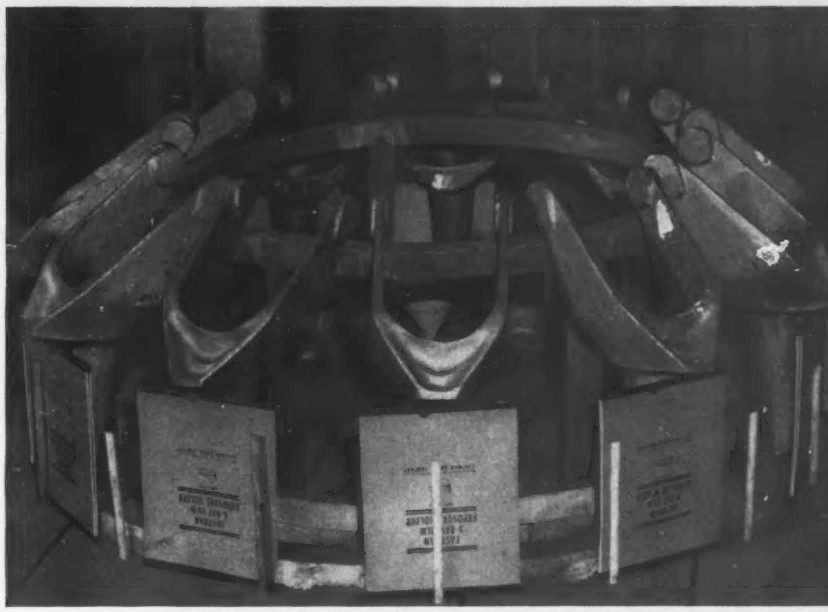


Fig. 3—Gamma-ray exposure of high strength steel alloy airplane landing forks prior to shipment; another example of 100 per cent radiographic casting inspection.

Fig. 4—Magnetic particle testing of a high pressure, low alloy valve body during the cleaning process. Surface defects which would not be found by normal visual inspection are easily detected. Operators are checking the areas for bore defects.

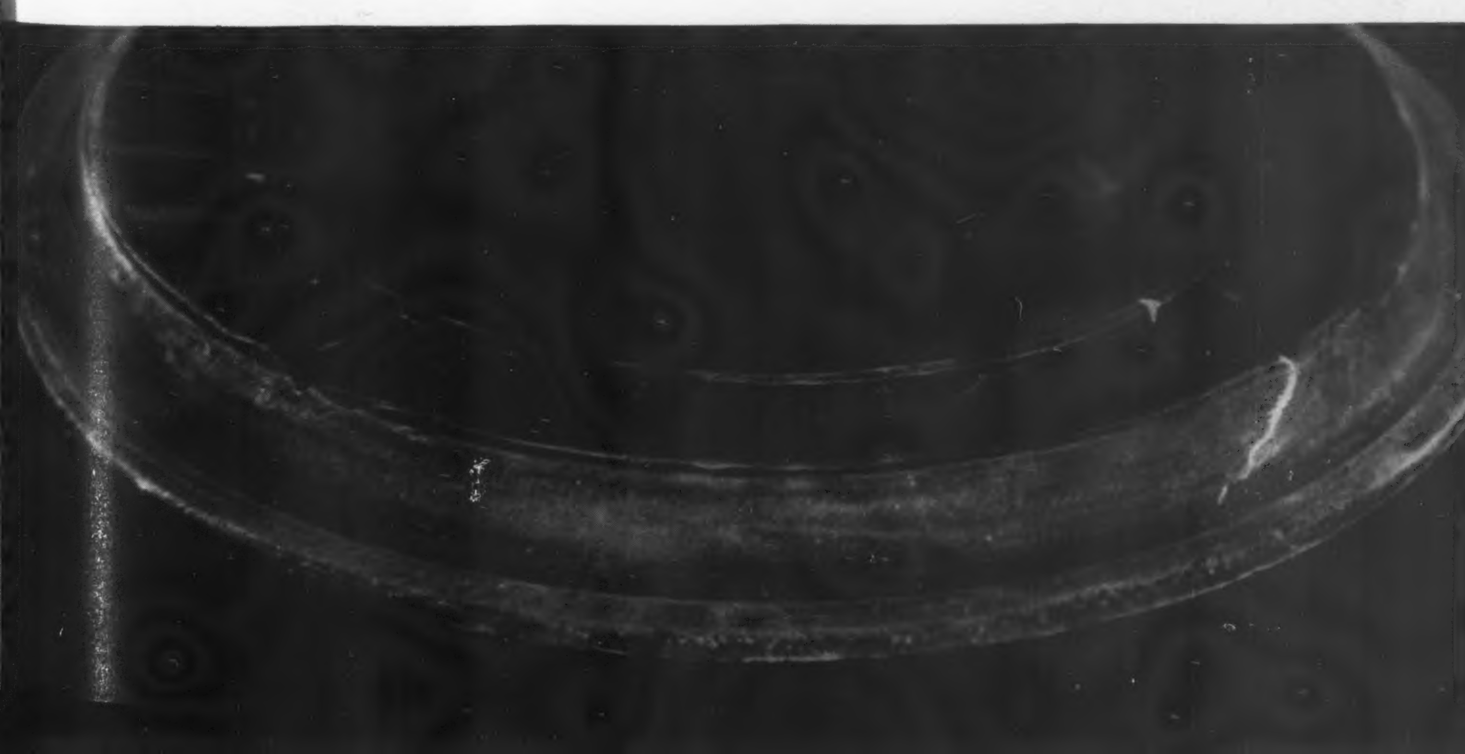
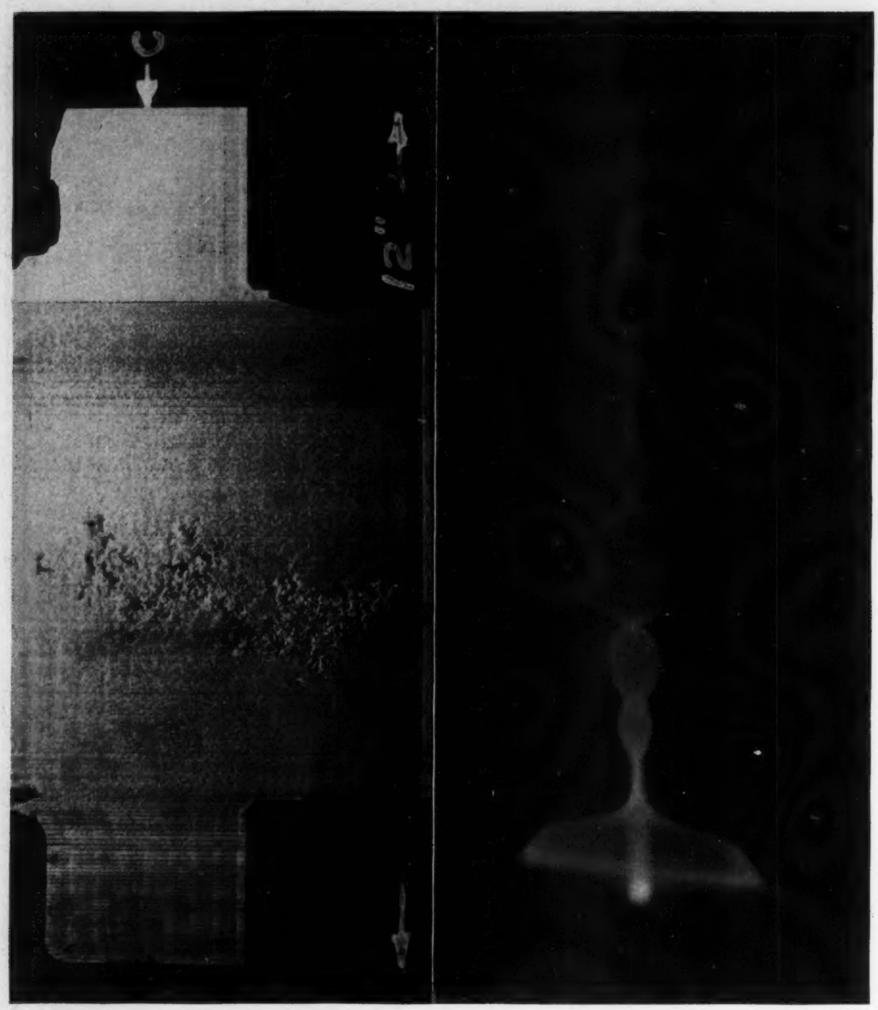


Fig. 5—An austenitic alloy supercharger casting being inspected by the fluorescent-penetrant method. Surface defects, which are cracks in this instance, would not be disclosed by a visual examination alone.



read from the oscilloscope pattern. Defects can be disclosed only when the beam reflections pass over the area at right angles. The location on one plane is established, and by calculation the distance from the surface is estimated. In order to explore all areas, complete scanning of all sections is required. This appears to be a tedious method and, if full coverage is required, radiographic examination may be more economical.

The supersonic reflectoscope is an instrument which provides non-destructive testing of castings that other methods do not afford. It supplements radiography. This is a new tool for the foundryman, and it is now commanding considerable attention for the exploration of castings.

Fig. 7—A 12-in. casting, sectioned, showing internal shrinkage. The quartz reflectoscope crystal was placed at "C" with the resulting oscilloscope pattern shown at the left. The two large pattern reflections represent the sending point "C" and the opposite wall. Variations of pattern within these sections represent discontinuities.

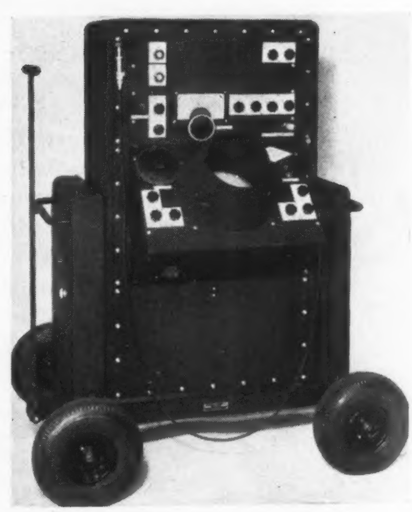


Fig. 6—Supersonic testing equipment capable of penetrating massive sections up to about 15 feet.

Other Non-Destructive Tests

Tests such as hydrostatic and air-pressure tests are employed in the steel foundry. Proof tests or static loading to a point just below the yield point, with measurement of any permanent set, are often made on rough or finished castings.

Jig-gaging on production castings as a final inspection is used (Fig. 8) as a means to insure adequate stock for machining, including the proper fit of the casting into machine tool fixtures. Individual layout procedure, with thorough checking of dimensional tolerances and wall thickness, is always a recommended practice on pilot sample castings.

It is difficult to indicate limits of dimensional tolerance in a blanket manner, but plus or minus 5 per cent or plus or minus $\frac{1}{16}$-in. wall thickness in the thinner wall sections has been accepted for certain classes of steel castings.

Design Precautions

Quality steel castings are not dependent upon non-destructive testing methods alone. Quality castings begin during the early stages of design. Close collaboration between the designer and the steel foundryman is vitally important, but only too often is neglected. Good, practical designs, which permit the foundryman to carefully plan his production methods, with directional solidification possibilities built into the design, are essential for highest quality.

It is not possible, for example, to feed metal from thin sections to thick sections, since the thinner section freezes early, while the heavy section still is molten. Directional solidification involves controlling the rate of solidification so that freezing normally will occur at the thinnest cross-section and gradually progress from that point toward the heaviest cross-section involved, which then may be adequately fed with hot metal from a suitably placed riser.

With the tapering and blending of wall sections built into the original design, sounder castings with freedom from internal shrinkage can be produced. Other methods of indirectly controlling directional solidification are available, such as

the differential thermal gradients resulting from the planning of heading and gating, effective chilling of areas, or padding (tapering) of sections, which padding subsequently must be removed (Fig. 9).

Designs with restraint should be avoided, as these often result in hot tears. Blending or streamlining heavy sections into lighter sections always is desirable, as well as the avoidance of abrupt angles with inadequate fillets. Proper designs always afford the foundryman an opportunity of feeding the casting adequately, thus avoiding internal shrinkage. Quality castings cannot be produced from every design, and this should not be expected. Many complex or "impossible" steel casting designs can best be produced with two or more castings welded into a unit.

Process controls of actual foundry operations are not only desirable but essential for the highest quality levels. Each step of production must be fully controlled in order to coincide with previous or subsequent operations.

Properly made pattern equipment is equally as important as design. Dimensional accuracy is necessarily dependent upon the pattern and core box equipment. Exceptionally close tolerances of castings are reproduced with proper pattern plus good molding equip-

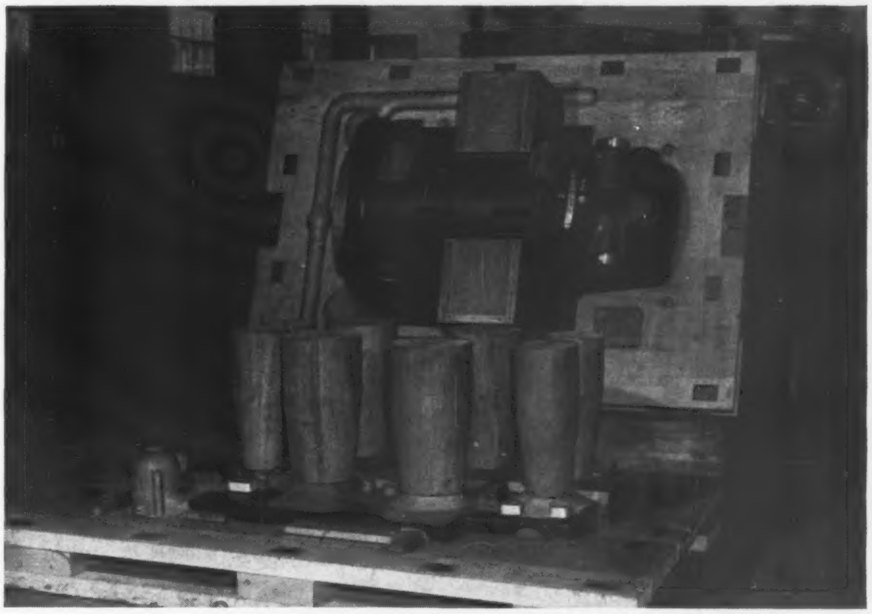


Fig. 8 (top)—A heat treated, high tensile alloy casting being jig-gaged in target fixture before shipment. This inspection insures proper and adequate finish allowances with over-all dimensional tolerances suitable to the subsequent machining.

Fig. 9 (center)—Pattern equipment used for pump case casting. Cope and drag pattern boards are shown with heading and gating carefully planned for a casting to meet radiographic standards for internal soundness. Note the padding required under each riser for directional solidification of the casting.

Fig. 10 (bottom)—Checking pouring temperature with an optical pyrometer. Mold and metal produced under controlled conditions.

ment and technique. Surprising dimensional results are possible when engineered equipment and controls are properly maintained.

From this point on, the quality of the casting remains in the hands and head of the steel foundryman. He must carefully plan his methods of heading, gating, molding and pouring. The most preferable method of heading and gating is to incorporate these essential parts of the rough casting on the pattern equipment, usually mounted integrally on a board (Fig. 9). This step leaves little to the individual molder's judgment and insures duplication of the method on subsequent castings once good practice has been established.

Process controls covering all other phases of operation are required. Variables in the molds and cores are minimized by material controls and consistent check of manually controlled operations. Good molds to receive metal of the proper metallurgical qualities are essential.

Pouring is one of the foundry operations which it is most necessary to control. Metal temperature varies, with consequent effects upon fluidity. Pouring rates invariably are manually controlled. Variation of both temperature and pouring rate vitally affects the soundness and cleanliness of the castings.

Temperature checks may be optically recorded (Fig. 10), and speed of pouring adjusted accordingly so that rates of freezing may be uniform and directional. Since these pouring variables are recognized as difficult to control, ample safety allowances must be made in design, heading and gating.

Adjusting Pilot Casting

After production under known conditions, the pilot casting is subjected to visual and non-destructive examinations by one or more of the previously outlined methods. If this sample casting fails to meet the quality or grade desired, changes usually are made in the basic foundry planning, or the customer's engineering department is requested to make adjustments in design. Once the pilot casting has met the quality requirements, production may start and, under the same controlled methods, similar quality castings may be expected.

Production castings, made by a satisfactorily controlled process, normally should possess no major defects. Refractory or other blemishes may occur, usually of surface origin. These minor defects must be visually located and repaired by welding, using a welding rod which produces properties comparable to those of the parent metal after final heat treatment.

Heat-Treating Factors

Under process controlled operations, it may be assumed that a satisfactorily sound casting has been produced, and which is dimensionally correct and ready for subsequent heat treatment. Heat-treating operations should be conducted under well controlled conditions, in uniformly heated and properly constructed furnaces.

Simple annealing treatments still are satisfactory for lower tensile strength requirements but, within the past few years, homogenizing, normalizing, quenching and tempering (or any combination) under controlled conditions has had a great effect upon the use and performance of high tensile steel castings. Cast armor is a good example of a casting on which exacting controls for quality must be maintained in the heat treatment, since ballistic testing of each casting is not possible.

Of course, after heat treatment, physical properties of the castings are checked by process control methods such as tensile, impact, hardness and other tests. Hardness tests often are taken on a percentage of castings from each heat treatment batch and, when required, 100 per cent of the castings are so inspected.

Visual final inspection of all castings is essential. Additional inspection of high quality castings may entail a 100 per cent inspection by one or more of the foregoing non-destructive methods. When satisfactory quality is consistently found and maintained, the frequency of testing may be reduced.

Inspection by any method adds to the ultimate cost of the casting. Unnecessary inspection is, therefore, a waste of man hours and should be held to a minimum. This can be accomplished by a thorough understanding of the service requirement, with specifications properly written for the grade or quality needed.

Interpretation of acceptable standards of steel casting quality is of utmost importance. Frequently, inexperienced inspectors have misinterpreted requirements of acceptable standards of quality which directly resulted in waste of useful castings, or an excessive amount of rework and repair. Acceptable standards, therefore, should be clearly defined and mutually agreed upon before undertaking any commitment.

References

1. *Radiographic Testing of Metal Castings,* ASTM Tentative Standard E-15-39T.

2. *Magnetic Particle Testing and Inspection of Steel Castings,* ASTM Tentative Standard A272-44T.

Announce Personnel of Gray Iron Division Committees

APPOINTMENTS to the 1947 Microstructure of Cast Iron and the Section Size Relationships committees, A.F.A. Gray Iron Division have been announced by Division Chairman T. E. Eagan, Cooper-Bessemer Corp., Grove City, Pa.

Members of the Microstructure committee are H. W. Lownie, Jr., Battelle Memorial Institute, Columbus, *Chairman;* R. W. Lindsay, Pennsylvania State College, *Vice-Chairman;* C. A. Johnson, Armour Research Foundation, Chicago, *Secretary;* Alfred Boyles, U. S. Pipe & Foundry Co., Burlington, N. J.; D. L. Edlund, Vanadium Corp. of America, Bridgeville, Pa., and W. R. McCrackin, Cooper-Bessemer Corp., Grove City.

R. W. Mason, International Nickel Co., Detroit, is *Chairman* of the Section Size Relationships committee, with W. W. Levi, Lynchburg Foundry Co., Lynchburg, Va., as *Vice-Chairman* and F. B. Rote, University of Michigan, Ann Arbor, as *Secretary.* Other members are R. L. Adams, National Supply Co., Toledo, Ohio; H. N. Bogart, Ford Motor Co., Dearborn, Mich., and Dr. R. A. Flinn, American Brake Shoe Co., Mahwah, N. J.

WHITEHEART MALLEABLE

INFLUENCE OF RAW MATERIALS

An abstract of the paper "Influence of Raw Material on Properties of Whiteheart Malleable Cast Iron with Special Reference to the Influence of Residual Elements" originally presented before the 43rd annual meeting of the Institute of British Foundrymen in Birmingham, England, June 18 to 21, 1946.

THROUGH THE COURTESY of the Institute of British Foundrymen, this abstract is presented in the belief that some of the information it contains may be of general interest to malleable iron metallurgists in this country, even though the investigation dealt with the effect of these various elements on the properties of whiteheart malleable cast iron and is not directly applicable to blackheart malleable as produced in this country's malleable iron foundries.

The committee originally charged with the preparation of this material was appointed in 1942 by the Technical Advisory Panel to the Directors for Iron Castings, Ministry of Supply, to investigate difficulties which had arisen in certain munitions components. The investigational work was conducted by the British Cast Iron Research Association under contract from the Ministry of Supply, Director-General of Scientific Research and Development.

The investigation which formed a part of this report was undertaken as a result of defects encountered in the production of certain whiteheart malleable iron components utilized in military vehicle construction. The subcommittee which conducted this investigation had as its object:

(*a*) To explore the differences which have occurred in the properties of malleable castings produced from mixtures containing refined iron and those produced from mixtures containing hematite pig iron and steel scrap.

(*b*) To investigate the influence of residual elements, which may be present in refined iron and hematite, used in the manufacture of malleable cast iron.

(*c*) To determine if, when burnt ingot mold scrap is used in the production of refined iron, this adversely affects the casting properties of the molten malleable iron and has a deleterious influence on the properties of the annealed malleable castings.

The base irons required for the investigation were produced under conditions comparable with commercial practice, and were therefore produced in commercial cupolas and cast into small pigs. The required test bars were cast after remelting this metal in an oil-fired crucible furnace. A total of 23 batches were cast from cupola melted metal.

All test bars were annealed under the same conditions and as far as possible in a continuous-tunnel gas-fired furnace, used for the annealing of commercial castings.

In the report of the original investigation, the test results of each series of bars were plotted to show the influence of the respective residual elements on the more important physical properties.

General Conclusions

For the purpose of this abstract, the general conclusions drawn by the investigators and as contained in the original report are included in this article in their entirety.

In applying the following conclusions to the commercial production of whiteheart malleable cast iron, it should be remembered that they relate to material melted in the manner described in this report and annealed in a particular manner. Modifications in any of these procedures may produce corresponding variations in the effects of the residual elements.

As far as the effects of the residual elements are concerned, the duration of the annealing cycle is of prime importance. The "hold" period of the annealing cycle used was relatively lengthy, and such an anneal tends to smooth out any differences introduced by the added elements. The effects of carbide stabilizer might, for instance, by arresting graphitization and thus promoting decarburization, be beneficial for a long cycle, but, due to the retention of carbide, be detrimental for a short cycle.

The conclusions are based upon the effects of the variables studied on the strength, ductility, shock resistance, microstructure, change in dimensions on annealing, mottling characteristics and hardness. No information was obtained on founding properties such as fluidity, life and susceptibility to porosity. The largest annealed section size studied was ⅞ in.x1 in. It is possible that the graphitizing elements would have been revealed in more dangerous light had larger sections been considered, although this point is covered to some extent by the study of the larger sections of the stepped bar.

From the results obtained it is possible to infer only to a limited extent the effects of various combinations of the residual elements. However, it can be safely assumed that the combined effects of the carbide stabilizers will be additive in the same direction, and a similar assumption may be made with respect to the graphitizers. When combination of graphitizers and carbide stabilizers occur together the investigators are disinclined to postulate their combined effects using as a basis the "graphitizing values" given to the various alloying elements.

With these considerations borne in mind, the following general con-

clusions were presented in entirety:

1. The analyses of the materials supplied for the investigation did not reveal any substantial differences between refined iron and hematite-base material in respect of their residual elements. In general, the refined base irons had higher carbon contents and lower sulphur contents. While in general the phosphorus contents of the hematite irons were lower than those of the refined irons, their ranges of composition for this element overlapped.

2. Nickel in annealed whiteheart malleable cast iron can be present in amounts up to 0.3 per cent without harmful effects.

3. Copper in amounts up to 0.7 per cent (maximum studied) had no adverse influence on the strength of the larger sections (5/8-in. to 7/8-in.) but tended to reduce ductility of small sections (3/8-in.).

4. In this investigation chromium in amounts up to 0.2 per cent did not have any harmful effect on the mechanical properties of the annealed material. With a shorter annealing cycle, lower silicon contents and higher sulphur contents, the dangerous chromium content may be lower.

5. Molybdenum in amounts up to 0.2 per cent (maximum studied) did not have any harmful effect on the mechanical properties. Molybdenum is a carbide stabilizing element, and as such its effects may be harmful in otherwise more difficultly graphitized irons, or in irons subjected to a shorter annealing cycle. This effect may be more apparent with the simultaneous presence of chromium.

6. Additions of ferro-silicon-titanium and ferro-carbon-titanium did not have any marked influence on mechanical properties, but the graphitization of the malleable iron, as indicated by its microstructure and the change of dimensions on annealing, was increased, as was also the tendency to mottle indicated by the thicker sections of the stepped test bar.

7. Tin had a feebly harmful effect, but in amounts up to about 0.1 per cent in an otherwise good malleable iron the harmful effects of the tin may not be appreciable.

8. Arsenic may be slightly harmful in amounts of the order of 0.1-0.2 per cent, but the effect is not pronounced. In an otherwise good malleable iron, smaller amounts might be tolerated without noticeable effect.

9. Small additions of boron (as ferro-boron) of the order of 0.003 to 0.004 per cent, may produce a marked increase in strength and graphitization, but also tend to reduce ductility. It is not yet clear whether these effects are due to the alloyed boron, or to the deoxidizing effect of the aluminum present in the ferro-boron used in these experiments. However, a melt to which equivalent amounts (0.001 to 0.005 per cent) of aluminum were added did not show the effect. It was found that 0.04 per cent boron completely inhibited graphitization, and so it is probable that the critically dangerous amount of this element is considerably lower.

10. Phosphorus tended to reduce the ductility of small sections and the shock-resistance of all sections in the annealed condition. Its effects on other mechanical properties are not clear. Other factors being equal, the best general mechanical properties are most likely to be obtained with the lowest phosphorus contents. The phosphorus content may be as high as 0.07 to 0.08 per cent for most purposes, and the difference between irons containing 0.05 and 0.07 per cent phosphorus may only be detected statistically. It is suggested that the lowest phosphorus contents are desirable when good shock resistance is required.

11. The carbide stabilizing elements chromium and molybdenum tended to reduce the amount of expansion on annealing of the larger sections and to increase the amount of contraction in the small sections. Tin and boron (in amounts greater than 0.1 per cent) behave in a similar manner.

12. The graphitizing elements nickel and copper tended to increase the amount of expansion on annealing of the larger sections and to reduce the amount of contraction of the small sections. Phosphorus behaved in a similar manner. It is possible that titanium and boron (in amounts of the order of 0.003 to 0.004 per cent) exert a similar graphitizing effect, but this needs to be confirmed.

13. Heavy relative decarburization, such as is experienced by 3/16-in. sections, tended to obliterate the effects of the residual elements except when they produced mottling in the original casting. This does not necessarily imply that the effects of the residual elements on the larger sections can be completely eliminated by an increase in the annealing time.

14. No "peeling" was encountered on any of the test bars used. It would appear that the residual elements did not favor the occurrence of this phenomenon under the conditions of the investigation.

15. No significant differences between refined iron and hematite-steel melts were reproduced or recorded in the investigation.

16. The effect of treatment of melts with hydrogen is obscure, but such treatment may have a harmful effect on mechanical properties.

17. "Deoxidation" of refined iron melts with up to 0.02 per cent aluminum, 0.02 per cent calcium as calcium silicide, and up to 0.1 per cent silicon as ferro-silicon-titanium had no effect on the mechanical properties. The latter addition, while improving the annealability (graphitization) of the metal, was liable to give free graphite in the unannealed castings, particularly in larger sections.

18. In this investigation no evidence was obtained that melting in contact with oxidized material caused the production of inferior malleable iron.

19. The investigation surveyed, examined and indicated the limiting tolerable amounts of the most commonly occurring residual elements. It is important to realize that the experiments used a hematite base material, but the individual conclusions should be equally applicable to both hematite base material and refined iron charges used as melting stock in the whiteheart malleable iron industry.

20. No harmful effect was detected as the result of the use of oxidized scrap in the preparation of refined iron on the annealability and mechanical properties of the resulting malleable iron.

★ NEW A. F. A. MEMBERS ★

January 10 to February 15—The two "baby" chapters, namely: Rocky Mountain Empire and Washington, lead all groups this month in the procurement of new members. Rocky Mountain Chapter added 38 members and Washington 20. Wisconsin, with 12, beat out Central Illinois which placed 11 names on the A.F.A. membership list. A total of 215 names are shown below with 31 chapters as contributors.

BIRMINGHAM DISTRICT CHAPTER

J. L. Cooper, Jr., American Cast Iron Pipe Co., Birmingham, Ala.
Luther A. Dixon, Fdry. Foreman, Unit Stove & Furnace Co., Birmingham, Ala.
R. A. Donaldson, V.P. & Gen. Mgr., Newbury Mfg. Co., Inc., Talladega, Ala.
A. N. Meister, Supt., Unit Stove & Furnace Co., Birmingham, Ala.

CANTON DISTRICT CHAPTER

Ralph T. Hipp, Mgr., Fredericksburg Clay Co., Fredericksburg, Ohio.

CENTRAL ILLINOIS CHAPTER

James R. Bell, Caterpillar Tractor Co., Peoria.
Paul England, Timestudy, Peoria Malleable Castings Co., Peoria.
Harold Hinshaw, Furnace Rm. Fore., Brass Foundry Co., Peoria.
Arthur King, Coreroom Fore., Brass Foundry Co., Peoria.
John R. Koestner, Partner, Paramount Foundry, Peoria.
Orval Leverett, Shipping Rm. Fore., Peoria Malleable Castings Co., Peoria.
James Lyons, Jr., Asst. Fdry. Fore., Brass Foundry Co., Peoria.
Levi C. Ricketts, Fdry. Fore., Brass Foundry Co., Peoria.
Stanley E. Robertson, Partner, Paramount Foundry, Peoria.
William Thornton, Plant Supt., Brass Foundry Co., Peoria.
Ralph Yerby, Shipping Rm. Fore., Brass Foundry Co., Peoria.

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W. H. Bradford, Fore., National Malleable & Steel Castings Co., Indianapolis.
George W. Hribernick, Sr., Fore. National Malleable & Steel Castings Co., Indianapolis.
W. S. Keck, Fore., National Malleable & Steel Castings Co., Indianapolis.
Anthony Loviscek, Fore., National Malleable & Steel Castings Co., Indianapolis.
Dwight H. Mahin, Eng. of Tests, Electric Steel Castings Co., Speedway City.
Frank Sabotin, Sr., Fore., National Malleable & Steel Castings Co., Indianapolis.

CENTRAL NEW YORK CHAPTER

Raymond Weber, Fore., Sweets Foundry, Inc., Johnson City.

CENTRAL OHIO CHAPTER

Edmund L. Thomas, Radiographer, Bonney Floyd Co., Columbus.

CHESAPEAKE CHAPTER

Lt. Hugo Guarda, Chilean Navy, Norfolk Naval Shipyard, Portsmouth, Va.
Oscar T. Marzke, Supt. Div. of Metallurgy, Naval Research Laboratory, Washington, D.C.

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***Canedy-Otto Mfg. Co., Chicago Heights, Ill. (R. A. Jentsch, Works Mgr.)**
Francis J. Meade, Ind'l Engr., The Chicago Hardware Foundry Co., North Chicago.
***Norton Co., Worcester, Mass. (R. E. Taylor, Dist. Mgr.)**
James R. O'Connell, Salesman, Mexico Refractories Co., Mexico, Mo.
***Pekay Machine Co., Chicago.**
J. McGowan, Western Foundry Co., Chicago.
William E. Wyatt, Director of Sales, Pekay Machine Co., Chicago.

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Laurance V. Savage, Works Mgr., The Detroit Steel Casting Co., Detroit.
Eugene L. Thomas, Sand Tech., Cadillac Motor Car Co., Detroit.
Edward L. Wiltz, Michigan Steel Casting Co., Detroit.

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Joseph Strachan, Patternmaker, Western Pattern Works, Montreal, Que.

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***American Foundry & Casting Co., Jersey City, N.J. (Willard L. Jacobs, V.P.)**
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Wilbur Hartl, Supv., American Aluminum Casting Co., Irvington, N.J.
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Charles Penl, Engr., American Aluminum Casting Co., Irvington, N.J.

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Lawrence A. Johnson, Fore., Oliver Corp., South Bend, Ind.
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David B. Hosie, Canadian Repr., Morgan Crucible Co., Toronto.
W. A. Jones, Met., Canadian Westinghouse Co., Ltd., Hamilton.
Archie McCoy, Owner, McCoy Foundry, Hamilton.
John Kenneth Sewior, Fore., Canadian General Electric Co., Ltd., Toronto.
Robert Thurlow, Salesman, Don Barnes Fdry., Supplies & Equip., Hamilton.

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QUAD-CITY CHAPTER

Lee Hoyes, Asst. Fore., Kewanee Boiler Corp., Kewanee, Ill.

* Company Members

ROCHESTER CHAPTER

Elliott T. Baker, Salesman, Cross Bros. Co., Inc., Rochester.
Arnold R. Fisk, Molder, General Railway Signal Co., Rochester.
A. C. Wischmeyer, Sr., Pres., Nunn Brass Works, Rochester.

ROCKY MOUNTAIN EMPIRE CHAPTER

Floyd R. Anderson, Chief Met., Gardner-Denver Co., Denver.
Roy W. Bailey, Shop Supt., McPherson Corp., Denver.
Mitchell P. Christensen, Dist. Repr., American Wheelabrator & Equipment Co., Denver.
William Ciancio, Mgr., Midwest Foundry Supply Co., Denver.
Shelby C. Cooke, Sr., Secy-Treas., U.S. Foundries, Inc., Denver.
James W. Creamer, Attorney, Western Foundry Co., Denver.
B. E. Dixon, Supt., American Brake Shoe Co., New York.
Geo. C. Donald, Proprietor, Geo. C. Donald Pattern Works, Denver.
C. C. Drake, Plant Supt., Griffin Wheel Co., Denver.
Darrell C. Durant, Asst. Supt., U.S. Foundries, Inc., Denver.
Howard E. Durant, Gen. Supt., U.S. Foundries, Inc, Denver
Wm. A. Goebel, Sr., Repr., Federal Foundry Supply Co., Cleveland.
Alvin O. Gruenwald, Asst. Secy., Manufacturers Foundry Corp., Denver.
Earl Allen Harris, Fdry. Fore., Western Foundry Co., Denver.
Glen D. Hobart, Salesman, National Carbon Co., Inc. Denver.
John W. Horner, Jr., V.P., Slack-Horner Brass Mfg. Co., Denver.
Joseph E. Horvat, Pattn. Shop Fore., Denver Fire Clay Co, Denver.
Elmer W. Hurrell, Fdry. Fore., Magnus Metal Div., National Lead Co., Denver.
Lynn Johnson, Secy-Treas., Slack-Horner Brass Mfg. Co., Denver.
Jerry Lahr, Owner, Aluminum Co. of Denver, Denver.
James R. Maclear, Co-Partner, Maclear Mfg. & Supply Co., Denver.
Thomas McBreen, Owner, Schuletter Iron Foundry, Denver.
***McPherson Corp., Denver. (E. Byron McPherson, Jr., V.P.)**
D. G. McPherson, Treas., McPherson Corp., Denver
Lewis W. McPherson, Secy., McPherson Corp., Denver.
J. Melvin Moore, Repr., S. Obermayer Co., Denver.
Pearson M. Payne, Manager, Rotary Steel Castings Co., Denver.
C. O. Penney, Met., C. S. Card Iron Works Co., Denver.
Wm. F. Pfau, Fdry Mgr., Electron Corp., Denver.
Leon Plamondon, Partner, Atlas Pattern Works, Denver.
Arthur L. Schneider, Owner, Western Bronze & Brass Foundry, Denver.
Andrew P. Smith, Supt., Magnus Metal Div., National Lead Co., Denver.
Ernest A. Tomeo, Owner, Midwest Foundry Supply Co., Denver.
Frank Tomeo, Fdry. Fore., Manufacturers Foundry Corp., Denver.
George Traut, Fore., Geo. C. Donald Pattern Works, Denver.
LeRoy Velie, Sales Repr., M. L. Foss, Inc., Denver.
***Western Foundry, Denver. (J. Ernest Higson, Partner)**
Edward B. Zabriskie, Plant Mgr., Magnus Metal Div., National Lead Co., Denver.

SAGINAW VALLEY CHAPTER

Thomas H. Cahape, Student Engr., Pontiac Motor Div., Pontiac, Mich.
Donald J. Gregory, Special Assignment, Central Foundry Div., Saginaw, Mich.
Joseph V. Koza, Student, Chevrolet-Saginaw Grey Iron Foundry, Saginaw, Mich.
H. S. Mahar, Repr., The United States Graphite Co., Saginaw, Mich.
Donald B. Phillips, Fdry. Supt., Lobdell-Emery Mfg. Co., Alma, Mich.
Fernando de Abreu Ribeiro, Electro-Mechanical Engr., General Motors Institute, Flint, Mich.

SOUTHERN CALIFORNIA CHAPTER

***Aztec Cast Iron Foundry, South Gate. (Pedro B. Cuevas, Owner)**
Leo Cuevas, Mgr., Aztec Cast Iron Foundry, South Gate.
Cecil E. Davis, Chief Clerk, General Metals Corp., Los Angeles.
Charles A. DeLaGrange, Owner, D & D Foundry, Temple City.
John G. James, Fore., Monarch Pattern & Foundry Co., Los Angeles.
James C. Mullaney, Jr., Snyder Foundry Supply Co., Los Angeles.
Carlton A. Ruggaber, Ind'l Engr., Rogers Pattern & Foundry Co., Los Angeles.
Conrad Clayton Wissmann, Met., Los Angeles Steel Casting Co., Los Angeles.

TEXAS CHAPTER

T. H. Robinson, Supt., McKinley Iron Works, Ft. Worth.
Bowie Sellers, Pattern Shop Fore., East Texas Electric Steel Co., Longview.
Vernon Shaw, Owner, Shaw Foundry Co., Dallas.

TOLEDO CHAPTER

Robert G. Bristow, Met., Bunting Brass & Bronze Co., Toledo.
William E. Fitzgerald, Sales Engr., Unit Cast Corp., Toledo.
Glenn V. Vollmer, Fdry. Prod. Mgr., Bunting Brass & Bronze Co., Toledo.

TWIN CITY CHAPTER

S. L. Anderson, Salesman, The E. R. Frost Co., Minneapolis.
John Gamec, Jr., Minneapolis-Moline Power Implement Co., Minneapolis.
Geo. E. Gladwin, Minneapolis-Moline Power Implement Co., Minneapolis.
John Hedervare, Fdry. Fore., Midway Iron Works, St. Paul.
Harold O. Heiber, Minneapolis-Moline Power Implement Co., Minneapolis.
Geo. A. Jensen, Minneapolis-Moline Power Implement Co., Minneapolis.
Clem Keeley, Mgr., Donouan Inc., St. Paul.
John W. Rhoads, Asst. Fdry. Supt., Minneapolis-Moline Power Implement Co., Minneapolis.
Walter Taylor, Fdry. Supt., Midway Iron Works, St. Paul.

WASHINGTON CHAPTER

Raymond P. Ball, Supt., Ball Brass Co., Tacoma.
***Coolidge Propeller Co., Seattle. (Fred Dobbs, Pres. & Mgr.)**
A. D. Cummings, Sales Engr., Western Foundry Sand Co., Seattle.
Howard R. Heath, Fdry. Supt., Sumner Iron Works, Everett.
John B. Howatt, Coremaker, Seattle Brass Co., Seattle.
***Carl F. Miller & Co., Inc., Seattle. (Carl F. Miller, Pres.)**
Ralph E. Miller, Met., Sumner Iron Works, Everett.
A. Miskimens, Fdry. Supt., Pacific Car & Foundry Co., Renton.
T. B. Monson, Works Mgr., Pacific Car & Foundry Co., Renton.
Jack H. Peterson, Mgr., Peterson Pattern Works, Seattle.
Harold Prentice, Fdry. Fore., Pacific Car & Founrdy Co., Renton.
George E. Rauen, Fdry. Supt., Seattle Brass Co., Seattle.
Frank C. Rogers, Supt., Olympic Steel Works, Seattle.
Barton N. Sather, Owner, Hagedorn Foundry Co., Everett.
John Skube, Fdry. Pattern Fore., Pacific Car & Foundry Co., Renton.
John T. Thomson, Patternmaker, Seattle Brass Co., Seattle.
Richard G. Wagner, Puget Sound Naval Shipyard, Bremerton.
Wm. E. Warren, Puget Sound Navy Shipyard, Bremerton.
***Western Foundry Sand Co., Seattle. (W. R. Tompkins)**
Alvin T. Zandt, Zandt Brass Foundry, Seattle.

WESTERN MICHIGAN CHAPTER

Judd Wm. Ambrose, Draftsman, Lakey Foundry & Machine Co., Muskegon.
Albert W. Demmler, Div. Met. & Res., Campbell, Wyant & Cannon Foundry Co., Muskegon.
Edward P. Fritz, Fore., Standard Automotive Parts Co., Muskegon.
Oscar E. Hoffman, Supv., Lakey Foundry & Machine Co., Muskegon.
Herbert R. Merwin, Mgr., Western Foundry, Holland.
Ross P. Shaffer, Met., Lakey Foundry & Machine Co., Muskegon.
Clarence D. Smith, Asst. Supt. Clg. Rm., Lakey Foundry & Machine Co, Muskegon.
Earl Ziel, Supv., Lakey Foundry & Machine Co., Muskegon.

WESTERN NEW YORK CHAPTER

A. B. Thomas, Plant Mgr., General Motors Corp., Central Foundry Div., Lockport.

WISCONSIN CHAPTER

John L. Cocking, Allis Chalmers Mfg. Co., Milwaukee.
Don M. Gerlinger, Met. Engr., Walter Gerlinger, Inc., Milwaukee.
Harold Haglund, Allis Chalmers Mfg. Co., Milwaukee.
A. F. Kobernick, Berlin Chapman Co., Berlin, Wis.
Leo McAvoy, Berlin Chapman Co., Berlin, Wis.
Ralph Michna, Pattern Shop Fore., Iroquois Foundry Co., Racine, Wis.
Eugene J. Mielke, Owner, Mielke Pattern Co., Milwaukee.
Lucien G. Osborne, Asst. to Supt., Lakeside Malleable Casting Co., Racine, Wis.
A. J. Schmidbauer, Prod. Mgr., Iroquois Foundry Co., Racine, Wis.
James H. Thomson, Dist. Sales Engr., American Wheelabrator & Equipment Co., Mishawaka, Ind.
Walter Vierthaler, Supt., Iroquois Foundry Co., Racine, Wis.
Harold Zuehlke, Allis Chalmers Mfg. Co., Milwaukee.

OUTSIDE OF CHAPTER

Dr. Waite Philip Fishel, Dept. of Chemistry, Vanderbilt University, Nashville, Tenn.

Willis H. Leonard, Supt., J. M. Leonard & Son, Inc., Osterville, Mass.

Leonard L. Martin, Gen. Mgr., Martin Mfg. Co., Ludlon, Mass.

ARGENTINA

Direccion de Industrias Mineras y Metalurgicas, Buenos Aires.

AUSTRALIA

A. E. Brinkworth, Chief Mech. Draftsman, Toowoomba Foundry Pty., Ltd., Toowoomba, Queensland.

Librarian, Sydney Technical College, Sydney, N. S.W.

BRAZIL

Paul Ivany, M.E., Mitec Industrias Brasileiras S/A Sao Paulo.

ENGLAND

H. G. Hoskins, Banbury, Oxon.

Lt. Col. Ku, Chinese Technical Mission, Rolls Royce Ltd., Derby.

Francis D. Powell, Tech. Mgr., Aeroplane & Motor Aluminum Castings Ltd., Birmingham.

Frank Wareing Nield, Chemist & Met., Henry Wallwork Co., Ltd., Manchester.

Stephen N. Wrightson, B.Sc., The English Steel Corp., Ltd., Sheffield.

FINLAND

B. M. Lehtonen, Director, Rauta-Ja Metallivalimo "Suomi," Helsinki.

INDIA

G. L. Gabriel, Mg. Director, Bombay Metal & Alloys Mfg. Co., Ltd., Bombay.

ITALY

Acciaierie e Ferriere Lombarde Faclk, Corso Matteotti 6, Milano.

Dalmine S/A, Bergamo.

Ing. Guido Vanzetti, Via Nerversa 1, Milano.

SWEDEN

Husqvarna Vapenfabriks Aktiebolag, Husqvarna.

* Company Members

WISCONSIN CHAPTER

Holds 10th Annual Conference

FOUNDRYMEN FROM ALL parts of Wisconsin and neighboring states, Indiana, Illinois, Michigan and Minnesota, as well as those from distant points, attended the 1947 Tenth Annual Regional Foundry Conference sponsored jointly by the A.F.A. Wisconsin Chapter and University of Wisconsin, Department of Mining and Metallurgy, Madison. Meetings, luncheons and the banquet were held in the Schroeder Hotel, Milwaukee. As announced in the January AMERICAN FOUNDRYMAN the conference was held February 13 and 14. A total of 600 foundrymen registered for the two day conclave.

The interest shown and the efficient manner in which the conference was conducted were distinctly complimentary to the conference chairman, R. J. Anderson, Belle City Malleable Iron Co., Racine Wis.; co-chairman R. C. Woodward, Bucyrus-Erie Co., So. Milwaukee, and associate chairmen, Professors E. R. Shorey and G. J. Barker, University of Wisconsin. The committee had the active support of the chapter officers, D. C. Zuege, Sivyer Steel Casting Co., Milwaukee, President; R. J. Anderson, Vice-President; R. C. Woodward, Secretary, and R. F. Jordan, Sterling Wheelbarrow Co., Milwaukee, treasurer. A. C. Haack, Wisconsin Gray Iron Foundry Co., Milwaukee, served as general program chairman.

Subject Matter Diversified

Embracing a variety of subjects dealing with the five major branches of the industry, the conference program was organized by a committee including S. E. Mueller, Falk Corporation, Milwaukee, steel program chairman; J. V. Olle, Motor Castings Co., West Allis, Wis., gray iron program chairman; C. M. Lewis, Badger Malleable & Mfg. Co., So. Milwaukee, malleable program chairman; A. K. Higgins, Allis Chalmers Mfg. Co., West Allis, Wis., non-ferrous program chairman; and M. C. Frankard, Delta Mfg. Co., Milwaukee, pattern program chairman.

Trained Engineers Needed

At the opening meeting Dean M. O. Withey, College of Engineering, University of Wisconsin, addressed the gathering. He discussed the problems of engineering colleges in the postwar era, stressing the shortage of trained engineers and what the university is doing to improve the situation. James Thomson, Continental Foundry & Machine Co., East Chicago, Ind., next speaker, offered a few hints and ideas on "Good Housekeeping."

"Modern Developments in Gating and Risering" was the subject discussed by Howard Taylor, Associate professor of mechanical metallurgy, Massachusetts Institute of Technology, Cambridge, at the steel session. Mr. Taylor emphasized the importance of directional solidification in the making of sound castings, pointing out that although the theory has long been recognized some new tools have been developed which make the practical attainment of proper temperature gradients possible. Commenting on insulators, the speaker cited an excellent insulator for non-ferrous metals but said no suitable insulator has been found for ferrous castings. It was shown that several ferrous and non-ferrous foundries have proved the practical value of insulated risers and exothermic riser compounds for promoting soundness of product and increasing yields.

Second speaker before this group was J. Richard Adams, vice-president, Crucible Steel Casting Co., Lansdowne, Pa. (This paper is published in full in this issue, see page pp. 26.) He discussed production of steel castings without venting of the molds. Mr. Adams stressed the elimination of venting and his views aroused considerable controversy and discussion.

Two talks were presented at the first gray iron session. Victor Rowell, Velsicol Corp, Chicago, spoke on "Properties of Sand Cores," and commented on the commonly recognized properties of permeability, green strength, flowability, dry and baked strength, hot strength, refractoriness of cores. Use of core binders was also discussed. Second discussion leader was O. Jay Myers, Werner G. Smith Co., Cleveland, who presented a paper on "Core Sand Testing and Core Practice." The speaker emphasized that core sand testing offers one means of reducing scrap.

Synthetic Sand Factors

Norman J. Dunbeck, vice-president, Eastern Clay Products, Inc., Jackson, Ohio, presented the final paper at the gray iron meeting. His subject, "The Economics of Synthetic Sand," was divided into four divisions: (1) what synthetic sand

The Wisconsin Regional Conference provided the photographs shown here. Luncheons, banquet and meeting rooms afforded opportunity for foundrymen to exchange ideas and greet old and new friends.

(Photos courtesy John Bing, A. P. Green Fire Brick Co.)

is; (2) who should use it; (3) what type clay should be used and (4) how to obtain maximum value. Each point was discussed in detail by the lecturer.

At the initial meeting of the malleable foundrymen, L. B. Knight, Lester B. Knight & Associates, Chicago, spoke on "Mechanization of Malleable Foundries." When a mechanization program is undertaken, it should be carefully planned, engineered and financed without jeopardy to working capital, he asserted.

A talk on "Modern Inspection Methods of Malleable Castings" was the second subject on the malleable agenda. Discussing the topic was U. S. Sullivan, Caterpillar Tractor Co., Peoria, Ill. Inspection methods of malleable castings at his plant were outlined along with the various tests used, i.e.; oil and chalk, fluorescent penetrant, x-ray and magnaflux.

Non-Ferrous Program

In the non-ferrous meeting room W. H. Baer, Naval Research Laboratory, Washington, D.C., enumerated the difficulties encountered in the production of bronze pressure castings and showed the necessity for determining the seriousness of the various types of defects. The speaker's investigation was confined to identifying the defects by means of radiography. Types of metal studied and cast at the laboratory were outlined and melting and pouring practice described. Mr. Baer's subject was "Radiographic Examination of Brass and Bronze Castings."

Herman Smith, American Smelting & Refining Co., Pittsburg, Pa., was the final non-ferrous speaker. His address "Non-Ferrous Melting Atmospheres" centered around oxi-

dizing and deoxidizing procedures and the use of fluxes.

Ladd Salach and Lee Cress were the pattern division speakers. The former, associated with Plastic Corp. of Chicago, as president, had for his subject "Plastic Patterns." A short history of low pressure resins and some of their wartime uses were given, as well as the advantages of plastic plates and specific adaptations of plastic patterns.

Mr. Cress, affiliated with Howard Foundry Co., Chicago, spoke on "Magnesium Pattern Equipment." Declaring that the use of magnesium for patterns is in its infancy, he cited production figures of a foundry using magnesium core boxes. Upkeep of magnesium patterns was also discussed.

An interesting and well-illustrated presentation on "Practical Interpretations of Hardenability" was made by E. J. Wellauer, director of research, Falk Corporation, Milwaukee, at the first technical session. Cooling rate curves for water and oil quenched bars were given as well as "S" curve diagrams for cast steels. Cast steel grain size characteristics were also outlined.

Using as an illustration his company's installation at Lehigh Foundries, Inc., Easton, Pa., J. W. Cable of the Induction Heating Corp., New York, discussed the "Dialectric Curing of Cores." On the premise that a jobbing foundry has greater flexibility, the speaker said its needs of a unit of this type is greater than that of a production foundry. Electric ovens are known to have baked cores that stood two and a half feet, he declared. The subject of toxic fumes was brought forth and Mr. Cable explained that there was no complaint—most vapor given off being water.

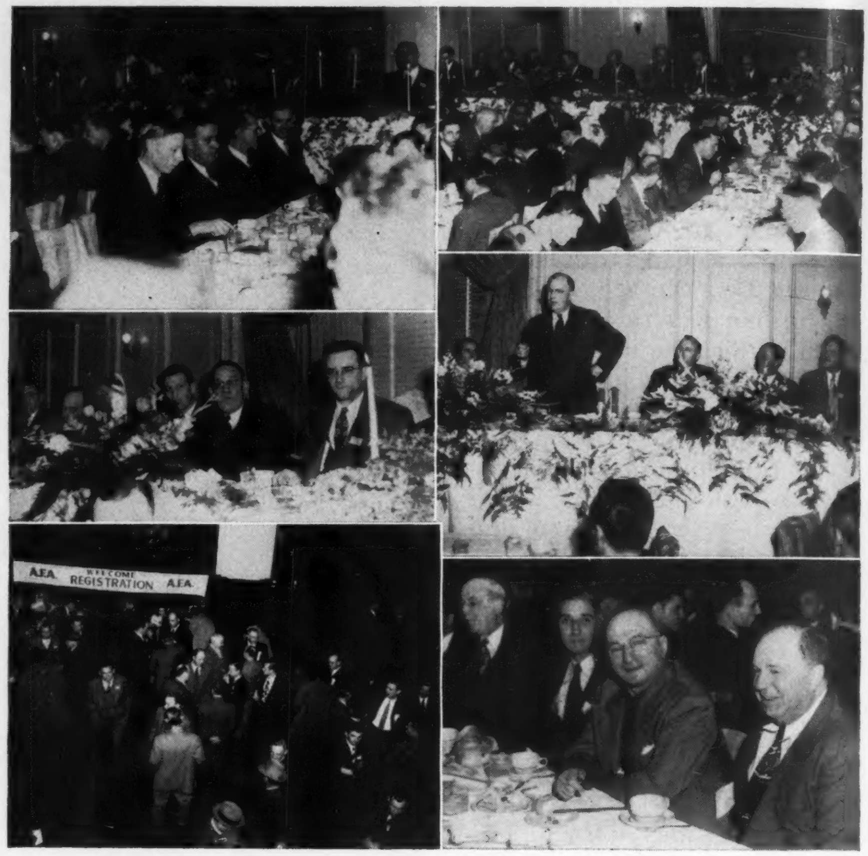
(Continued on page 86)

The Wisconsin chapter held its Tenth Annual Foundry Conference in conjunction with the University of Wisconsin, Madison. The event was well received as proven by the smiles of satisfaction on the faces of the men pictured on these pages.

(Photos courtesy John Bing, A. P. Green Fire Brick Co.)

Birmingham Foundrymen Meet

Southern Conference Outstanding



Persons and personalities present at the Fifteenth Annual Foundry Practice Conference sponsored by the A.F.A. Birmingham District chapter, February 20-22, Tutwiler Hotel, Birmigham. Attendance neared the 500 mark.
(Photos courtesy John C. Graham, Jr., Stockham Pipe Fittings Co.)

ONE OF THE MOST successful annual foundry practice conferences ever held by the A.F.A. Birmingham District chapter reached its climax with the annual banquet February 21, when 485 foundrymen and friends heard Dr. J. L. Brakefield speak on "Current Trends."

The conference was the fifteenth sponsored by the chapter and its predecessor, the Birmingham Foundrymen's Association.

"If democracy is to survive in the nation, Americans must change their philosophy from that of seeking easy wealth and comfort to one of production and work." the speaker said. Dr. Brakefield is secretary of the industrial development division, Birmingham Chamber of Commerce.

Explaining that the world crisis means danger and opportunity, Dr. Brakefield said the United States had met crisis after crisis since the founding of the nation. "We met the dangers and seized the opportunities," he said "until 1918, when we met the danger but failed to grasp the opportunity. We forgot about the danger and went heedlessly on our way, piling up paper fortunes and letting the rest of the world go its way."

Many Questions From Floor

The speaker was introduced by James W. Moore, member of the president's staff, American Cast Iron Pipe Co., Birmingham, who served as toastmaster.

The technical sessions on foundry practice were well attended, and the subject matter brought many questions from the floor, following each speaker's presentation. L. D. Pridmore, vice-president, International Molding Machine Co., Chicago, spoke on "Core Blowing Equipment;" John P. Sellas, sales manager, Precision Castings Div., Michigan Steel Castings Co., Detroit, explained the processes involved in precision casting, and Raymond Foster, assistant metallurgist, Lynchburg Foundry Co., Lynchburg, Va., discussed "Foundry Sands." F. G. Sefing, development and research division, International Nickel Co., New York, presented data on "Some Alloy Irons for Wear and Corrosion Resistance," while "Cupola Melting of Gray Iron" was the topic so well presented by W. B. McFerrin, Electro Metallurgical Co., Detroit.

The following members of the program committee were responsible for the well rounded program which drew foundrymen from many states other than Alabama: W. E. Jones, Chairman, Stockham Pipe Fittings Co.; J. E. Getzen, Co-Chairman, H. G. Mouat Co.; J. A. Bowers, American Cast Iron Pipe Co.; Morris Hawkins, Stockham Pipe Fittings Co., and Paul Jacks, Goslin-Birmingham Mfg. Co., all of Birmingham.

A full program of entertainment was provided on Thursday evening, several hundred delegates enjoying a fine floor show, topped off by the showing of the film of the Georgia-North Carolina Sugar Bowl football game.

In informal sessions many of the industry's production problems were under review, and those who know the situation in this area well predicted that attendance of southern foundrymen at the annual convention of the American Foundrymen's Association in Detroit, next month, will be large.

Additional photographs taken at the Fifteenth Annual Foundry Practice Conference sponsored by the A.F.A. Birmingham District chapter. Top (left)—Dr. J. L. Brakefield, secretary, industrial development div., Chamber of Commerce, Birmingham, banquet speaker and (right) James W. Moore, American Cast Iron Pipe Co., Birmingham, banquet toastmaster, pause to chat before the dinner. (Center)—National secretary-treasurer W. W. Maloney, Chicago and Tom Johnston (right), Republic Steel Co., Cleveland, exchange greetings as do Past National President L. N. Shannon (left), vice-president, Stockham Pipe Fittings Co., Birmingham, and National President S. V. Wood, president, Minneapolis Electric Steel Castings Co., Minneapolis, in the background. (Right)—Speakers at the conference were (left to right) F. G. Sefing, International Nickel Co., New York; W. B. McFerrin, Electro Metallurgical Co., Detroit; John P. Sellas, Precision Castings Div., Michigan Steel Castings Co., Detroit; L. D. Pridmore, International Molding Machine Co., Chicago; and W. E. Jones, Stockham Pipe Fittings Co., Vice-Chairman, Birmingham District chapter. Bottom (left)—L. D. Pridmore addresses the first technical session on "Core Blowing Equipment," as J. E. Getzen (left), H. G. Mouat Co., Birmingham, acts as chairman of the session and Gene Welchel, American Cast Iron Pipe Co., Birmingham, looks on. (Center)—Left to right W. W. Maloney, S. V. Wood and Chapter Chairman T. H. Benners, Jr., T. H. Benners & Co., Birmingham, discuss conference activities. (Right)—Howard Nelson, Hill & Griffith Co., Birmingham, Chairman, Registration Committee and assistants ready for business.

Foundrymen attending the conference were afforded the opportunity of visiting 21 foundry establishments in the Birmingham district. The plant visitation committee was under the chairmanship of J. T. Gilbert, Stockham Pipe Fittings Co., with John F. Wakeland, Alabama Foundry Co., Birmingham, as co-chairman.

Executive Group

Birmingham foundrymen congratulated the chapter officers for a job well done in planning and organizing the conference. The executive group consisted of Chapter Chairman T. H. Benners, Jr., T. H. Benners & Co.; Vice-Chairman W. E. Jones, Stockham Pipe Fittings Co.; and Fred K. Brown, Adams, Rowe & Norman, Inc., Secretary-Treasurer, all of Birmingham.

Members who presided at the technical sessions and introduced the speakers, were: J. E. Getzen, sales engineer, H. G. Mouat Co.; J. A. Bowers, superintendent melting, American Cast Iron Pipe Co.; Charles K. Donoho, plant metallurgist, American Cast Iron Pipe Co.; E. A. Thomas, president, Thomas Foundries; Ned Brandler, Electro Metallurgical Co., all of Birmingham.

Executive officers of A.F.A. who attended the conference were National President S. V. Wood, president, Minneapolis Electric Steel Castings Co., Minneapolis, and W. W. Maloney, National Secretary-Treasurer, Chicago. Mr. Wood was the featured speaker at the conference luncheon. His topic was the "Activities of A.F.A."

Describing the national organization as an educational institution, Mr. Wood said the purposes of A.F.A. are to give wide distribution to foundry information and knowledge, to stimulate technical research, to encourage in-shop training of technicians and to encourage young men to find a future in the foundry industry. He said metallurgical and other research is constantly bringing to light new facts of great value to the industry and to the nation.

President Wood warned the foundrymen against a tendency to allow themselves "to get in a rut." He suggested that youth be given freer rein in the industry. "Young men will make as many mistakes as we did," he asserted, "but they can and will do a creditable job."

FOUNDRY PERSONALITIES

Dr. J. T. MacKenzie, chief metallurgist, American Cast Iron Pipe Co., Birmingham, Ala., has been elected to the board of directors of the firm and will serve in the capacity of technical director. He has been with the company since 1912. Dr. MacKenzie, internationally recognized and frequently honored (he received the A.F.A., J. H. Whiting Gold Medal in 1937) as an outstanding foundry chemist and metallurgist, will deliver the first Charles Edgar Hoyt Annual Lecture at the 51st Annual Meeting of A.F.A., in Detroit, April 28-May 1.

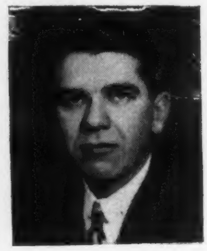
At the annual meeting of the board of American Cast Iron Pipe Co., **C. D. Barr** was reelected president; **C. O. Hodges,** senior vice-president and treasurer; **S. D. Moxley,** vice-president in charge of purchasing and engineering; **J. J. Swenson,** vice-president in charge of sales, and secretary; and **F. B. Shannon,** assistant treasurer.

R. W. Parsons R. W. Tindula

R. W. Tindula, formerly metallurgist, Symington-Gould Corp., Rochester, N.Y., has joined the Naval Research Laboratory, Washington, D. C., as head of the steel castings section. Member of A.F.A. and active in Rochester chapter, Mr. Tindula will be associated with Chesapeake chapter. He holds a master of science degree from Carnegie Institute of Technology, Pittsburgh, Pa., and has been associated with Battelle Memorial Institute, Columbus, Ohio; Republic Steel Corp., Buffalo and Port Henry, N. Y., and International Silver Co., Meriden, Conn.

R. W. Parsons, chief metallurgical engineer, Ohio Brass Co., Mansfield, Ohio, and associated with the engineering department of the firm for 20 years, has been named technical director. A member of A.F.A., with Northeastern Ohio chapter, he also serves on the Program and Papers Committee, Brass and Bronze Division.

G. K. Dreher, National Director, American Foundrymen's Association, has announced his resignation as vice-president and general manager, Rogers Pattern & Foundry Co., Los Angeles. He has not announced his plans for the future.



R. L. Collier Vincent Manka

Vincent Manka, for the past three years general sales manager, Claud S. Gordon Co., Chicago, was recently elected vice-president of the firm.

R. L. Collier, formerly executive secretary, Steel Founders' Society of America, Cleveland, and associated with that organization for more than 18 years, has been appointed executive vice-president, Gray Iron Founders' Society, Inc., Cleveland. He plans to conduct an exhaustive survey of the gray iron industry, on the basis of which the society will build its program.

W. E. Mahin, chairman, metals division, Armour Research Foundation, Chicago, has been named editor of the new "USCO News Casting," a monthly digest issued by U. S. Reduction Co., East Chicago, Ind. Mr. Mahin is well known to the readers of AMERICAN FOUNDRYMAN as an author of many technical technical papers. In A.F.A. activities he has served as Chairman and as Secretary, A.F.A. Gray Iron Division, and is currently a member of the Executive Committee of that division, as well as of the Melting, Casting and Finishing Subcommittee, A.F.A. Precision Investment Casting Committee.

B. T. Cowherd, until recently deputy zone administrator, War Assets Administration, Chicago, has resigned that position to join Republic Drill & Tool Co., Chicago, as vice-president in charge of sales in eastern states. He will make his headquarters at the firm's New York plant.

W. L. Sturtevant, chemical engineer, Manhattan Rubber Div., Raybestos-Manhattan, Inc., Passaic, N.J., was honored on his retirement recently by a dinner attended by more than 100 friends and co-workers. Associated with the firm since 1912, Mr. Sturtevant served as its representative on many government and scientific committees: he was awarded a Naval Ordnance emblem for services during the war as a member of the Navy's rubber reserve committee. Author of numerous articles and technical papers on testing rubber goods and fabrics, he has been active in the ACS and ASTM.

A. J. Miller was elected chairman of the board, and **A. Y. Gregory,** president, at a recent meeting of the directors of Whitehead Brothers Co., New York. Other officers elected are: **J. H. Whitehead,** vice-president and secretary; **Christian Mathiesen,** vice-president; **E. C. Lass,** treasurer; **T. F. O'Leary,** assistant treasurer; and **C. C. McKay,** assistant secretary.

S. L. Anderson, formerly with Whiting Corp., Harvey, Ill., has joined E. R. Frost Co., Minneapolis. An A.F.A. member, he is affiliated with the Twin City chapter.

W. E. Mahin Miss Fitzpatrick

Anthony Sutowski has joined the Cleveland Trade School, of that city, as instructor in the foundry division. He is a native of Cleveland, attended John Carroll University and was graduated from Cleveland College. Mr. Sutowski received his foundry shop experience through an apprenticeship at Forest City Foundries Co. He has also been associated with Aluminum Co. of America, Wellman Bronze & Aluminum Co., John Harsch Bronze Co., Hill Acme Co., and Ohio Foundry Co., all of Cleveland.

Miss Mildred A. FitzPatrick, Vanadium Corp. of America, Detroit, will shortly begin her 26th year as secretary in the office of that firm. Graduated in 1922 at Queen's University, Kingston, Ont., with a bachelor of arts degree, Miss FitzPatrick joined the Vanadium organization the same year, and has since acquired a formidable background in metallurgy. Although she entered the metals field with the intention of remaining only until an opportunity to use her background in English, political economy and philosophy arose elsewhere, Miss FitzPatrick, today, explains that she may refuse such an opportunity. After a quarter-century of service, she finds the metals field still fascinating. Her duties are those of an executive secretary, although she has no official title, in view of the "temporary" nature of her position.

H. J. French, since 1943 assistant manager, Research and Development Div., International Nickel Co., New York, has

been appointed assistant vice-president, International Nickel Co. of Canada, Ltd. Associated with the International Nickel organization since 1929, when he joined its research laboratories in Bayonne, N. J., Mr. French was in charge of alloy steel development for 12 years prior to his appointment as assistant manager. He was awarded the Henry Marion Howe Medal of the American Society for Steel Treating in 1931, and, in 1933, was the Edward de Mille Campbell memorial lecturer for the American Society for Metals, of which he is a past president.

D. J. Reese has been placed in charge of all field sections of the division, formerly under the direction of Mr. French, and will continue to head the iron and nonferrous casting section. A.F.A. Gold Medalist and long active in the Association, Mr. Reese is a member of the Advisory Group, A.F.A. Gray Iron Division.

O. B. J. Fraser has been named assistant manager, Research and Development Div., succeeding H. J. French. **Dr. W. A. Mudge** has been appointed director of the technical services section of the division, the position formerly held by Mr. Fraser. **W. F. Burchfield** will serve as assistant to Dr. Mudge.

H. W. Kane

G. S. Evans

Samuel Appelby has been appointed district manager at Buffalo, N. Y., for W. G. Reichert Engineering Co. Member of A.F.A., he is associated with Western New York chapter and has also been active in National committees. Recently, he has served on the Program and Papers Committee, Gray Iron Division, and the Core Test Committee, Foundry Sand Research Project. Mr. Appelby has been associated with the Blaw-Knox Co. and the Buffalo Foundry & Machine Co., both of Buffalo.

G. S. Evans, Mathieson Alkali Works, New York, has retired as metallurgist in charge of fused alkali products for the metals trade. He will continue his association with the company, as a consultant. **R. C. Strong,** recently appointed manager, Fused Alkali Div., will take over supervision of "Purite" sales. Mr. Evans, who joined the Mathieson firm in 1925, after 15 years experience as a chemist and metallurgist, is a graduate of Virginia Polytechnic Institute, Blacksburg, Va., and has been granted many patents pertaining to the use of alkalies in metallurgical operations. An A.F.A. member, he also holds membership in AIME, and is the author of numerous articles and technical papers.

V. C. Faulkner, London, editor of *Foundry Trade Journal,* has been nominated for Vice-President, International Committee of Foundry Technical Associations, by the Institute of British Foundrymen. In 1926, Mr. Faulkner, then President, IBF, helped organize the International Committee. He holds membership in A.F.A. dating back to 1922, and is well known in this country through his published articles and papers.

N. S. Covacevich, owner, Casa Covacevich, Mexico, D. F., was a recent visitor to the A.F.A. National Office and a guest at the January 9 meeting of Northeastern Ohio A.F.A. chapter, during a visit to this country. Secretary, Mexico City A.F.A. chapter, Mr. Covacevich is a charter member of that group and one of the most active in its undertakings. He was in the United States on a visit to foundries, foundry suppliers and equipment manufacturers.

H. W. Kane, vice-president and general manager, Kane & Roach, Inc., Syracuse, N.Y., was elected president of the firm, succeeding his father, the late **W. E. Kane,** at a recent meeting of the directors.

Robert Logie has been elected treasurer and assistant secretary and will serve as a member of the board, National Roll & Foundry Co., Avonmore, Pa., and **Francis Nash,** formerly assistant secretary, has been named secretary.

C. W. Culbertson has been appointed metallurgical engineer, McNally Pittsburg Foundries, Inc., Pittsburg, Kansas, and will be in charge of technical advisory service for the firm.

R. M. Allen, vice-president in charge of sales, Allegheny Ludlum Steel Corp., Pittsburgh, Pa., has announced the addition of ten men to the sales staff. The ten, selected from various departments and graduates of a training course conducted by the firm, are: **W. H. Adamson; G. D. Bunder; G. A. Estabrook; W. G. Memphill; H. M. McMeans; S. M. McCroskey; J. B. Parsons; E. W. Schnabel; E. J. Stein,** and **R. A. Wille.**

Obituaries

Herman W. Falk, chairman of the board, Falk Corp., Milwaukee, and a director, Allis-Chalmers Mfg. Co., of the same city, died February 17 at Daytona Beach, Fla., following a heart attack.

Founder of the Falk Corp., Mr. Falk was also a member of the executive committee of the Allis-Chalmers firm, a member of the board of Heil Co., and president, Falk Investment Co. and Hope Investment Co.

W. F. Gollmar, manager, Elyria Foundry Div., Industrial Brownhoist Corp., Elyria, Ohio, died January 16.

Carl C. Hermann, president and general manager, C. C. Hermann & Associates, Detroit, died January 20.

Mr. Hermann, who had a background of extensive experience in sales and engineering of dust collecting equipment, had been associated with Claude B. Schneible Co., Chicago, prior to moving to Detroit. While at Chicago, he was an active member of the Chicago A.F.A. chapter, and he continued his work for the Association with the Detroit chapter. Mr. Hermann also served on the A.F.A. Industrial Hygiene Codes Committee.

M. E. First

Mahlon E. First, Cleveland, Ohio, for the past 25 years in charge of engineering and the design of material handling and processing equipment for C. O. Bartlett & Snow Co., Cleveland, died February 9. He was a director of the firm.

Before joining the Ohio company, Mr. First had been manager of both the Indiana Harbor and Alliance, Ohio, plants of American Steel Foundries.

Mr. First originated and perfected many widely-used methods and mechanical devices for handling sand, molds, castings.

L. H. August, foundry engineer, Hughes Tool Co., Houston, Texas, died February 3 at his home in Houston.

An A.F.A. member, Mr. August was Vice-Chairman of the Texas chapter and a charter member of that group, in which he had been a most active participant.

Mr. August was a native of Luling, Texas, where he attended public school. He attended Texas A & M, and joined the Hughes company in 1925.

Henry Ormer, owner, Washington Foundry Co., St. Paul, Minn., died January 18. He was the founder of the Washington company, and had become well known in the industry during the 58 years he operated a foundry.

Edward E. Walker, former president of Erie Malleable Iron Co., Erie, Pa., died February 19, at his home in that city.

For many years a leading figure in the malleable iron industry, Mr. Walker had been associated with the automobile wheel business since 1932, and at the time of his death was president of the Walker Corp. and Van Products Co. Mr. Walker was a former director of the Peoples Bank, Erie, and the Erie Chamber of Commerce.

Frank Eltrup, Covington, Ky., former owner of two foundries there, died January 2. Resident of Covington most of his life, Mr. Eltrup had operated the Insurance Foundry and the Kenton Foundry.

★ CHAPTER ACTIVITIES ★

news

Cincinnati District

E. F. Kindinger
Williams & Co.
Chapter Secretary

New procedures and materials will greatly affect the future of patternmaking, E. T. Kindt, Kindt-Collins Co., Cleveland, told the members of Cincinnati District A.F.A. chapter at their meeting of February 10 in Engineering Society Headquarters, Cincinnati.

Presenting "Comments on Pattern Engineering," Mr. Kindt, who is Chairman, Standard Pattern Supplies Committee, A.F.A. Pattern Division, referred to recent development in methods and materials as he cited the role of chemistry and research in contributing to improvements in patternmaking practice.

The speaker, in reviewing the main aspects of his topic, presented recommendations on factors to consider in building a new pattern shop; selecting proper equipment and designing the most efficient layout for such equipment; figuring drafts for patterns, core boxes and prints; pattern engineering for green sand molds; and the engineering and manufacture of permanent molds. Principles employed in figuring costs on wood and metal patterns were also detailed by Mr. Kindt, and other fundamentals of pattern shop operation were considered.

Chapter Chairman J. S. Schumacher, Hill & Griffith Co., Cincinnati, presided at the meeting, and 150 members and guests attended.

At the preceding meeting, January 13 in Engineering Society Headquarters, the chapter heard a discussion of "Human Relations" by Dr. R. L. Lee, General Motors Corp., Detroit.

Outlining the fundamentals of leadership, Dr. Lee told the foundrymen: "A leader is a man who is not afraid of his job, who believes his work is important. . . Leaders are men who work not only to get the means to live, but because they find in their work a reason for living." Relationships between supervisory personnel and the men in the shop come under the heading of the much-neglected science of "Humanics," which plays a vital role in production, he explained.

Central Illinois

G. H. Rockwell
Caterpillar Tractor Co.
Chapter Secretary-Treasurer

Gates and risers for sound castings was the topic of the technical session at the January 6 meeting of Central Ilinois A.F.A. chapter in the Jefferson Hotel, Peoria. H. C. Winte, Worthington Pump & Machinery Corp., Buffalo, N.Y., and Chairman, Western New York A.F.A. chapter, was the speaker.

Mr. Winte detailed the principles of sound gating and risering and of directional solidification, and analyzed current practices. A fine group of slides, illustrating the major points of the presentation, stimulated the interest of the foundrymen, who raised for consideration during the general discussion period various problems encountered in their own experience.

C. E. Bales, Ironton Firebrick Co., Ironton, Ohio, was speaker of the evening at the technical session of the chapter's February 3 meeting in the Jefferson Hotel. "Modern Foundry Refractories" was the topic, and Mr. Bales, with the aid of slides, conducted the foundry-

H. C. Winte (center), Worthington Pump & Machinery Corp., Buffalo, and Chairman, Western New York A.F.A. chapter, was speaker of the evening at the January 6 meeting of Central Illinois chapter in the Jefferson Hotel, Peoria. He is shown conferring with, left, Chapter Director L. E. Roby, Peoria Malleable Castings Co., and Chapter Chairman Zigmond Madacey, Caterpillar Tractor Co., Peoria.

men on a tour through his firm's modern plant. He drew from an extensive background in the refractories field for his observations on the characteristics and properties of refractory materials for the foundry and their origin and processing.

D. W. Barry (left), Minco Products Corp., Saginaw, Mich., speaker of the evening at the January 10 meeting of Southern California A.F.A. chapter in Roger Young Auditorium, Los Angeles, is shown as he paused for a chat with Chapter President W. D. Emmett (center), Los Angeles Steel Castings Co., Los Angeles, and Judge LeRoy Dawson, Los Angeles Municipal Court, who delivered the coffee talk.

University of Minnesota

Opportunities in the foundry industry for college graduates were described to 48 students and faculty members of the University of Minnesota, Minneapolis, February 6, by H. F. Scobie of the A.F.A. National Staff. Mr. Scobie was speaker of the evening before the first open meeting of the reorganized University of Minnesota Student A.F.A. chapter, held in the Student Union.

Organized early in 1941, the student foundry group became inactive during the latter part of the war. With resumption of activities, Howard Tomasko has been elected *Chairman;* and John Hermanson, *Secretary-Treasurer.* James Whelan has been named Chairman, publicity committee. J. H. Anderson, instructor in foundry practice at the university, one of the organizers of and an officer in the original chapter, is chapter advisor.

Several representatives of Twin City A.F.A. chapter, including Chapter Chairman H. M. Patton, American Hoist & Derrick Co., St. Paul, Minn.; J. W. Costello, of the same firm, and Carter DeLaittre, Minneapolis Electric Steel Casting Co., Minneapolis, were at the open meeting. Mr. Patton expressed the interest of his group and promised the students its aid and cooperation.

Chicago

"Have pride in your industry," A.F.A. President S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, urged Chicago A.F.A. chapter members and guests at the group's National Officers Night meeting, February 3.

"Look forward, adopt new methods, make use of the younger men in the field," President Wood ad-

Some of the 550 members and guests of Eastern Canada and Newfoundland A.F.A. chapter at its "Ladies Night" dinner dance, December 6, are shown in the main ballroom of the Mount Royal Hotel, Montreal. Attendance broke all chapter records for the annual event.

vised his listeners. The older and more experienced men play a very vital role in the castings industry, he declared, but younger men are likely to be less tradition-bound and more inclined to try the job that "can't be done."

Characterizing A.F.A. as "a technical educational institution" which has contributed, and is contributing greatly to the technological advancement of the foundry field, President Wood stressed the spirit of friendship and cooperation in the chapters he had visited. Such cameraderie, together with the exchange of information on foundry technology, promote pride of craft, he observed.

In concluding, he emphasized the need for young men in the field, and cited the role of the Association's apprentice training and engineering school activities in demonstrating to students and other young men the oportunities that exist for careers in the foundry industry.

Among the A.F.A. officers and staff members present were National Directors B. L. Simpson, National Engineering Co., Chicago, and J. E. Kolb, Caterpillar Tractor Co,, Peoria, Ill.; Wm. W. Maloney, Secretary-Treasurer; S. C. Massari, Technical Director, and H. F. Scobie, Educational Assistant.

G. W. Anselman, Goebig Mineral Supply Co., Chicago, and a member of the Analysis of Casting Defects Committee, A.F.A. Gray Iron Division, was the technical speaker of the evening on "Casting Defects —Causes and Remedies." Chapter President L. H. Hahn, Sivyer Steel Casting Co., Chicago, presided.

Western Michigan

K. C. McCready
Muskegon Piston Ring Co.
Chapter Reporter

An explanation of the "lost wax" process and descriptions of other methods and processes in use today in precision casting, were given members and guests of Western Michigan A.F.A. chapter, meeting February 10 in the Hotel Schuler, Grand Haven, by Morris Bean, Morris Bean & Co., Yellow Springs, Ohio.

Chapter Chairman Rudolph Flora, Clover Foundry Co., Muskegon, presided, and C. N. Damm, Pyle Pattern & Mfg. Co., Muskegon Heights, introduced Mr. Bean, whose talk led to an interesting and extended general discussion.

At the February 3 meeting of the Chicago chapter National President S. V. Wood (right, top) was one of the National officers who visited the chapter. (Right, bottom) Larry Hahn introducing George Anselman, guest speaker.

Michiana

S. F. Krzeszewski
American Wheelabrator & Equipment Co.
Chapter Director

NON-FERROUS FOUNDERS of the Michiana A.F.A. chapter area took the opportunity to submit the problems they encounter in practice during the general discussion period of the technical session at the February 4 meeting in the Hotel LaSalle, South Bend, Ind. W. E. Sicha, research metallurgist, Aluminum Co., of America, Cleveland, and a member of the Research Committee, A.F.A. Aluminum and Research Division, was the technical speaker.

At Wisconsin A.F.A. chapter's National Officers Night meeting, January 10 in the Hotel Schroeder, Milwaukee: left to right, A. C. Ziebell, Universal Foundry Co., Oshkosh, nominee for A.F.A. Director; A. H. Chatley, Delta Mfg. Co., Milwaukee; B. D. Claffey, General Malleable Corp., Waukesha, and Chapter Secretary R. C. Woodward, Bucyrus-Erie Co., Milwaukee.

Mr. Sicha outlined methods and practices for the production of high quality aluminum castings and responded to the questions of the members with specific recommendations as to their problems. In the main body of his discourse on "Aluminum," the speaker outlined the steps in the manufacture of the metal and indicated the wide range of its applications in industry.

Chapter Secretary-Treasurer V. S. Spears, American Wheelabrator & Equipment Corp., Mishawaka, Ind., presided at the meeting, and the program was under the direction of Chapter Director Earl Byers, Sibley Machine & Foundry Co. South Bend, Ind., chairman of the chapter program committee.

The National Officers visiting the Chicago chapter meeting held February 3 at the Chicago Bar Association were greeted by a large contingent of local foundrymen. Top (left to right)—Roy Frazier, Love Bros., Inc., Aurora, Ill.; George Anselman, Goebig Mineral Supply Co., Chicago; Chapter Chairman Larry Hahn, Sivyer Steel Castings Co., Chicago; National President S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis; National Director B. L. Simpson, National Engineering Co., Chicago and National Director J. E. Kolb, Caterpillar Tractor Co., Peoria, Ill. Bottom (clockwise)—Max Becker, M. F. Becker & Associates, Chicago; Jim Thomson, Continental Foundry & Machine Co., East Chicago, Ind.; Fred Gregg Whiting Corp., Harvey, Ill.; and E. F. Ross, Penton Publishing Co., Chicago.

Advantages of foundry mechanization were explained to chapter members at the January 7 meeting in the Hotel LaSalle, as Kennard Lange, manager, foundry division, Link-Belt Co., Chicago, analyzed modern mechanization of foundries.

All foundrymen should consider improvements through some degree of mechanization, Mr. Lange said, pointing out that, although not all foundries can become fully mechanized, it is possible, in most cases, to better working conditions, eliminate difficult jobs, such as shakeout, and provide opportunity to utilize less skilled help, through careful selection of equipment.

Chapter Vice-Chairman J. H. Miller, Josam Products Foundry Co., Michigan City, Ind., presided.

Twin City

THE SECRET of core blowing is uniformity of control, after a successful balance of factors has been achieved, L. D. Pridmore, International Molding Machine Co., Chicago, told members and guests of Twin City A.F.A. chapter, January 14 in the Curtis Hotel, Minneapolis.

Flowability of the sand and the blower air pressure, on one hand, and core requirements, on the other, determine the blowhole and vent size and arrangement, the speaker said; and widely different arrangements may provide like results under varied conditions.

Types of vents, and their location

and size; air pressure suitable for core blowing, which varies with core requirement; direction and position of blow holes; moisture in core sand; core boxes; blower plates, and characteristics of blown cores, were other aspects discussed.

Detroit

C. J. Rittinger
American Car & Foundry Co.
Chapter Reporter

TECHNICAL SESSIONS of the January 16 and February 20 meetings of Detroit A.F.A. chapter in the Rackham Educational Memorial, took the form of round table discussion on gray iron, malleable iron, aluminum, at the former; gray iron, steel and copper, at the latter.

W. B. Wallis, Pittsburgh Lectromelt Furnace Corp., Pittsburgh, Pa., and 1947 nominee for A.F.A. Vice-President, described new techniques, such as oxygen and air treatment of molten baths, in the production of steel castings in his talk on "The Arc Furnace in the Foundry Industry" before the steel session. Chapter R. J. Wilcox, Michigan Steel Castings Co., Detroit, served as group chairman.

"Copper and Copper-Alloy Castings for Resistance Welding Machines," was the topic of Armand DiGiulio, consulting engineer, Detroit, at the non-ferrous group session. G. M. Gaebler, Commerce Pattern Foundry & Machine Co., Detroit, was the chairman.

At the gray iron meeting of February 20, R. G. McElwee, Vanadium Corp. of America, Detroit, and Chairman, Cupola Research Committee, A.F.A. Gray Iron Division, spoke on "Cupola Practice Under Material Difficulties," and added to the recommendations of his formal presentation during a lively general discussion period. More than 100 foundrymen were in attendance. E. C. Jeter, Ford Motor Co., Dearborn, Mich., presided.

The gray iron session at the January meeting was also marked by lively discussion among the foundrymen, following the talk on "Gray Iron Casting Defects," by W. B. McFerrin, Electro-Metallurgical Co., Detroit, and Co-Chairman, Analysis of Casting Defects Committee, A.F.A. Gray Iron Division. Chairman was E. C. Jeter.

W. E. Sicha, Aluminum Co. of America, Cleveland, who serves as a member of the Research Committee, A.F.A. Aluminum and Magnesium Division, was the speaker on "Commercial Cast Aluminum Alloys" at the aluminum round table; while A. W. Stolzenburg, Aluminum Co. of America, Detroit, acted as chairman. Mr. Sicha covered melting, molding, heat treatment and properties of castings.

The complete process of manufacture of a special metal, and the factors which differentiate that metal from regular malleable iron, were described by Fred Winscher, Semet-Solvay Co., Detroit, speaking on "Z Metal Characteristics and Properties," before the malleable iron gathering. R. F. Green, Detroit Brass & Malleable Works, of that city, presided at the session.

Central New York

J. A. Feola
Crouse-Hinds Co.
Chairman, Publicity Committee

MEMBERSHIP PARTICIPATION in the technical session at Central New York A.F.A. chapter was again at a high level February 14, as the group held its regular meeting in the Onondaga Hotel, Syracuse. Round table discussions followed the lecture, third in the series, on "Metallurgy," by Prof. J. O. Jeffrey, Cornell University, Ithaca, N.Y.

The Iron-Carbon Diagram and its applications and the Jominy bar method for determining the hardenability of steels, were covered in the talk by Prof. Jeffrey. He stressed the importance of determining hardenability during the war, when steel of desired specification was not always readily available.

Scenes from Wisconsin A.F.A. chapter's National Officers Night meeting, January 10 at the Hotel Schroeder, Milwaukee: top, A.F.A. President S. V. Wood (center) Minneapolis Electric Steel Castings Co., Minneapolis, with Wm. W. Maloney (left), A.F.A. Secretary-Treasurer, and Chapter President D. C. Zuege, Sivyer Steel Casting Co., Milwaukee. Bottom, left to right, Chapter Treasurer R. F. Jordan and I. R. Smith, both of Sterling Wheelbarrow Co.; Leon Decker, Allis-Chalmers Mfg. Co., and G. E. Tisdale, Zenith Foundry Co., all of Milwaukee.

(Photos courtesy John Bing, A. P. Green Fire Brick Co.)

Leaders for the round table sessions were: J. H. Sibbison, Jr., Malleable Founders' Society, Cleveland, for the malleable group; J. F. Dobbs, New York Air Brake Co., Watertown, N.Y., the gray iron section; and G. M. Thrasher, R. Lavin & Sons, Elmira, N.Y., non-ferrous.

Chapter Chairman E. E. Hook, Dayton Oil Co., Syracuse, presided. It was announced that the 90 members and guests present had traveled a total of 6,600 miles to attend.

The cameraman found this group exchanging observations at the January 10 meeting of Southern California A.F.A. chapter in Roger Young Auditorium, Los Angeles: left to right, Harry Richey, Penton Publishing Co., Cleveland; Chapter Vice-President H. E. Russill, Eld Metal Co., Los Angeles; A.F.A. National Director G. K. Dreher, Rogers Pattern & Foundry Co., Los Angeles, and A. W. Gregg, Whiting Corp., Harvey, Ill.

Southern California

Maurice Beam
Los Angeles Times
Chapter Reporter

Crucible materials are responsive to the intense heat to which they are subjected, members and guests of Southern California A.F.A. chapter, meeting in February in Los Angeles, were reminded by L. A. Behrendt, of the Joseph Dixon Crucible Co., Jersey City, N.J.

It must be remembered, Mr. Behrendt advised in his discussion of "Crucibles in the Foundry Industry," that new crucibles must be properly "broken in;" that of the two types, clay graphite and carbon bonded, the former requires annealing, the latter does not; and that accessories suitable for use with one type may not be equally suitable for use with the other.

The January 10 meeting of the chapter in Roger Young Auditorium heard D. W. Barry, Minco Products Corp., Saginaw, Mich., discuss foundry sands. By mixing proper bonding elements, Mr. Barry pointed out, either natural or synthetic sands can be brought to meet the requirements of any metal to be cast, in any size. In general, he said, sands can be suited to any refinements in foundry techniques with the proper "know-how" on bonding. Bonds, the speaker stated, "take the guesswork out of molding" and facilitate control.

At the January 10 meeting in Roger Young Auditorium, Los Angeles, members of the educational committee, Southern California A.F.A. chapter, paused for the camera: left to right, Gordon Sondraker, Chamberlain Co., Los Angeles; P. C. Seichert, Alhambra Foundry Co., Alhambra; committee chairman W. D. Bailey, Jr., Westlectric Castings, Inc., Los Angeles, and Chapter Secretary L. O. Hofstetter, Brumley-Donaldson Co., of the same city; E. K. Smith, consulting metallurgist, Beverely Hills; Chapter President W. D. Emmett, Los Angeles Steel Castings Co., and Chapter Director R. R. Haley, Advance Aluminum & Brass Co., Los Angeles.

Texas

R. H. Glenney
Alamo Iron Works
Chapter Director

Suggestions on "Safety and Good Housekeeping in Foundries" were set forth by the coffee speaker, R. G. Naul, Hughes Tool Co., Houston, at Texas A.F.A. chapter's January meeting in the Blackstone Hotel, Fort Worth.

A. C. Sinnett, Texas Foundries, Inc., Lufkin, was the technical speaker of the evening, and his analysis of foundry cost accounting, highlighting the necessity for highly trained personnel for this type of work, and for compilation of basic data, provided the foundrymen with material for a lively and extended general discussion of foundry cost control methods.

"Sand Control" was the topic of the technical session at the chapter meeting of December 6 in the Plaza Hotel, San Antonio; and H. W. Dietert, Harry W. Dietert Co., Detroit,

CHAPTER MEETINGS

MARCH-APRIL

MARCH 17
QUAD CITY
Fort Armstrong Hotel
Rock Island, Ill.
R. L. McIlvaine
National Engineering Co.
Foundry Mechanization

CHESAPEAKE
Engineers Club, Baltimore, Md.
C. H. Lorig
Battelle Memorial Institute
Foundry Problems

MARCH 19
CONNECTICUT NON-FERROUS
Hotel Taft, New Haven
Round Table Discussions

MARCH 20
DETROIT
Rackham Educational Memorial
Max Kuniansky
Lynchburg Foundry Co.
National Officers Night

CANTON DISTRICT
Portage Hotel, Akron, Ohio
Quiz Night

OREGON
Heathman Hotel, Portland
E. J. McAfee
Puget Sound Navy Shipyard
Plastics in the Foundry and Pattern Industries

MARCH 21
TEXAS
Beaumont
Nathan Janco
Centrifugal Casting Machine Co.
Centrifugal Castings

BIRMINGHAM DISTRICT
Tutwiler Hotel, Birmingham, Ala.
W. B. George
R. Lavin & Sons, Inc.
Brass Foundry Practice

MARCH 24
NORTHWESTERN PENNSYLVANIA
Moose Club, Erie
Tom Barlow
Battelle Memorial Institute
Practical Inoculation of Gray Iron

CENTRAL OHIO
Chittenden Hotel, Columbus
L. W. Dean
Dean Co.
Precision Casting

MARCH 25
ROCKY MOUNTAIN EMPIRE
Oxford Hotel, Denver, Colo.
L. P. Robinson
Werner G. Smith Co.
Variables in the Core Room

MARCH 28
ONTARIO
Royal Connaught Hotel, Hamilton
Round Table Discussions

FOUNDRY CONFERENCE
MARCH 28-29
NEW ENGLAND FOUNDRYMEN'S ASSOCIATION
Massachusetts Institute of Technology, Cambridge
Seventh New England Conference

APRIL 3
SAGINAW VALLEY
Fischer's Hotel, Frankenmuth, Mich.
Oliver Smalley
Meehanite Metals Corp.
Waste in the Foundry Industry

APRIL 4
SOUTHERN CALIFORNIA
Roger Young Auditorium, Los Angeles
J. A. Kayser
LaClede-Christy Co.

WESTERN NEW YORK
Hotel Touraine, Buffalo
C. E. Westover
Westover Engineers

APRIL 7
METROPOLITAN
Essex House, Newark, N.J.
B. A. Miller
Baldwin Locomotive Works, Inc.
Non-Ferrous Castings

CENTRAL INDIANA
Anthenæum, Indianapolis
N. J. Dunbeck
Eastern Clay Products Co.
How to Select a Bond Clay

CENTRAL ILLINOIS
Jefferson Hotel, Peoria
V. A. Crosby
Climax Molybdenum Co.
Factors Affecting the Physical Properties of Gray Iron

APRIL 8
ROCHESTER
Seneca Hotel
Pat Dwyer
The Foundry
Foundries Past and Present

APRIL 10
ST. LOUIS DISTRICT
York Hotel, St. Louis
Edward Walcher
Ohio Steel Co.
Steel

APRIL 11
PHILADELPHIA
Engineers Club
F. W. Hanson
Electro Metallurgical Co.
Conservation Alloys in Steel Manufacture

EASTERN CANADA-NEWFOUNDLAND
Mount Royal Hotel, Montreal, Que.
Peter Blackwood
Ford Motor Co. of Canada, Ltd.
High Heat-Resisting Alloys and Tool Steels

NORTHERN CALIFORNIA
Engineers Club, San Francisco
J. A. Kayser
Laclede-Christy Clay Products Co.
Refractories

TEXAS
Lufkin
F. G. Sefing
International Nickel Co.
High Test Gray Iron
National Officers Night

APRIL 14
CINCINNATI DISTRICT
Anthony Wayne Hotel, Hamilton, Ohio
L. P. Robinson
Werner G. Smith Co.
What's New in the Core Room

WESTERN MICHIGAN
Hotel Schuler, Grand Haven
J. A. Rassenfoss
American Steel Foundries
The Manufacture, Design and Application of Steel Castings

APRIL 17
TWIN CITY
Curtis Hotel, Minneapolis
A. F. Pfeiffer
Allis-Chalmers Mfg. Co.
Casting Dimensional Control

the speaker. Mr. Dietert, long active in A.F.A. sand study groups and currently Chairman of the Flowability and Physical Properties of Iron Molding Materials committees, A.F.A. Sand Division, stressed the importance of routine testing. He suggested causes for casting defects generally attributed to heat absorption and gas pressure, and reported on current research into facing materials and gassed molds. His subject was illustrated by motion pictures in color.

Chapter Chairman W. M. Ferguson, Texas Electric Steel Castings Co., Houston, presided at both meetings of the chapter.

Rochester

D. E. Webster
American Laundry Machinery Co.
Chapter Director

GUEST SPEAKER C. A. Sanders, American Colloid Co., Chicago, described "Modern Progress in Foundry Sand Practice" at the January 14 meeting of Rochester A.F.A. chapter in the Seneca Hotel, there.

Much has been learned in recent years about the physical characteristics of clays, the speaker pointed out, and this knowledge permits a choice of clays to produce desired properties in foundry sand, properties that make possible accurate and clean castings in molds which break down readily in shake-out. It is becoming more and more important to use up-to-date foundry sand control methods, he said.

Knowledge of the physical properties of clays, Mr. Sanders explained, and consideration of grain size—particularly of grain distribution—make possible close control of the sand properties. Such control

An informal gathering at the January 31 meeting of Ontario A.F.A. chapter in the Royal Connaught Hotel, Hamilton: left to right, Fred Jobson, William Kennedy & Sons, Ltd., Owen Sound; Chapter Chairman J. A. Wotherspoon, Imperial Iron Corp., Ltd., St. Catherines, and Chapter Director J. H. King, Werner G. Smith, Ltd., Toronto, all of Ontario; G. E. Bales, Ironton Firebrick Co., Ironton, Ohio, speaker of the evening, and H. J. Miller, Walker Metal Products, Ltd., Windsor, Ont.

Members of Mexico City A.F.A. chapter (at top) were guests of La Consolidada, S.A., and inspected the modern plant (bottom) of that firm in the course of a special program celebrating the first anniversary of the organization of the chapter, November 7.

is the key to the solution of those problems created by scabs, washes, blows and metal penetration, which result from the improper preparation or faulty mixture of the sand.

Ontario

R. C. Tiplady
Westman Publications, Ltd.
Chapter Publicity Director

"THE QUESTION OF which refractory block to use in a cupola melting zone where melting is done continuously for eight hours, is hard to answer," C. E. Bales, Ironton Firebrick Co., Ironton, Ohio, explained in his discussion of foundry refractories at the January meeting of Ontario A.F.A. chapter in the Royal Connaught Hotel, Hamilton.

"Service obtained depends not only upon the properties of the refractory itself, but to a greater extent, upon the manner of cupola operation and the care used in repair of the lining," he explained.

The speaker described the types of refractories in common use and their properties, advantages and disadvantages; and pointed out many of the factors that contribute to wear of the lining, such as intense heat in the melting zone, chemical erosion by flux and slag, cutting action of the blast, abrasion by the charge, and breakage loss.

Chapter Chairman J. A. Wotherspoon, Imperial Iron Corp., Ltd., St. Catharines, Ont., was presiding officer, and H. J. Miller, Walker Metal Products, Ltd., Windsor, Ont., introduced the speaker.

St. Louis District

J. W. Kelin
American Smelting & Refining Co.
Chapter Reporter

GRAY IRON FOUNDRYMEN of the St. Louis District A.F.A. chapter area displayed a keen interest in "Practical Inoculation of Gray Iron," at the chapter's February meeting in the York Hotel, St. Louis. T. E. Barlow, Battelle Memorial Institute, Columbus, Ohio, was speaker.

In the general discussion following presentation of his technical paper, Mr. Barlow replied to the questions and observations of the foundrymen with specific recommendations in regard to problems encountered in practice, and with additional data regarding inoculants and application techniques.

During the business portion of the meeting, the chapter apprentice training committee chairman, T. H. Ross, instructor in patternmaking, David Rankin Jr. School of Mechanical Trades, St. Louis, outlined the pre-convention apprentice competition in the A.F.A. National Apprentice Contest. He discussed contest regulations in detail, and pointed out that prizes have been increased this year.

Chesapeake

J. A. Reese
Koppers Co., Inc.
Chapter Reporter

ROUND TABLE DISCUSSION featured one of the most successful technical sessions in the history of Chesapeake A.F.A. chapter, January 24, at the Engineers Club, Baltimore, Md.

C. L. Lane, Florence Pipe Foundry & Machine Co., Florence, N.J., led the discussion in the gray iron group; H. L. Smith, Federated Metals Div., American Smelting & Refining Co., Pittsburgh, Pa., was discussion leader for the non-ferrous session, and J. W. Juppenlatz, Lebanon Steel Foundry, Lebanon, Pa., headed the steel meeting.

Quad City

C. R. Marthens
Marthens Co.
Chapter Secretary-Treasurer

SUBJECT of the February 17 meeting of Quad City A.F.A. chapter, at the Fort Armstrong Hotel, Rock Island, Ill., was "Timely Comments on Pattern Engineering," by E. T. Kindt, Kindt-Collins Co., Cleveland.

Members of the pattern industry, Mr. Kindt said, can do a real service to the castings industry by using the latest machinery and methods available to them and by working in close cooperation with engineering and foundry departments in the design of a proper pattern.

At the January 20 meeting in the Fort Armstrong Hotel, C. A. Sanders, American Colloid Co., Chicago, was the technical speaker, and his discussion of "Foundry Sand Practice" held the interest of the foundrymen and produced an interesting general discussion period following his presentation.

New England

M. A. Hosmer
Hunt-Spiller Mfg. Co.
Association Reporter

ENGINEERING PROPERTIES of gray iron, particularly toughness and wear resistance, are improved through the use of inoculants, J. E. Fifield, International Nickel Co., Hartford, Conn., technical speaker at the February meeting of the New England Foundrymen's Association in the Engineers Club, Boston, Mass., explained in his discussion of "Inoculation of Gray Iron."

Inoculation changes the properties of cast iron by affecting the form and distribution of graphite and carbides, Mr. Fifield pointed out. Silicon-bearing alloys are the largest and strongest group of inoculants, and most contain, in addition to the silicon, elements that produce alloying effects, he added.

Three functions of inoculants, the speaker said, help prevent chilled edges and hard spots, and improve the engineering properties: the tendency to convert excess carbides into graphite; to convert types "D" and "E" graphite into type "A," and to insure uniform graphite flake size from the center to the surface of a casting.

Inoculants should be added at the cupola spout or in a ladle one-third full of molten iron, and small particles should be used. Quantity, which varies with total carbon content of the iron, carbon-silicon balance, thickness of metal sections in the casting, and presence of alloying elements in the cupola iron, may best be determined by chill control, Mr. Fifield said.

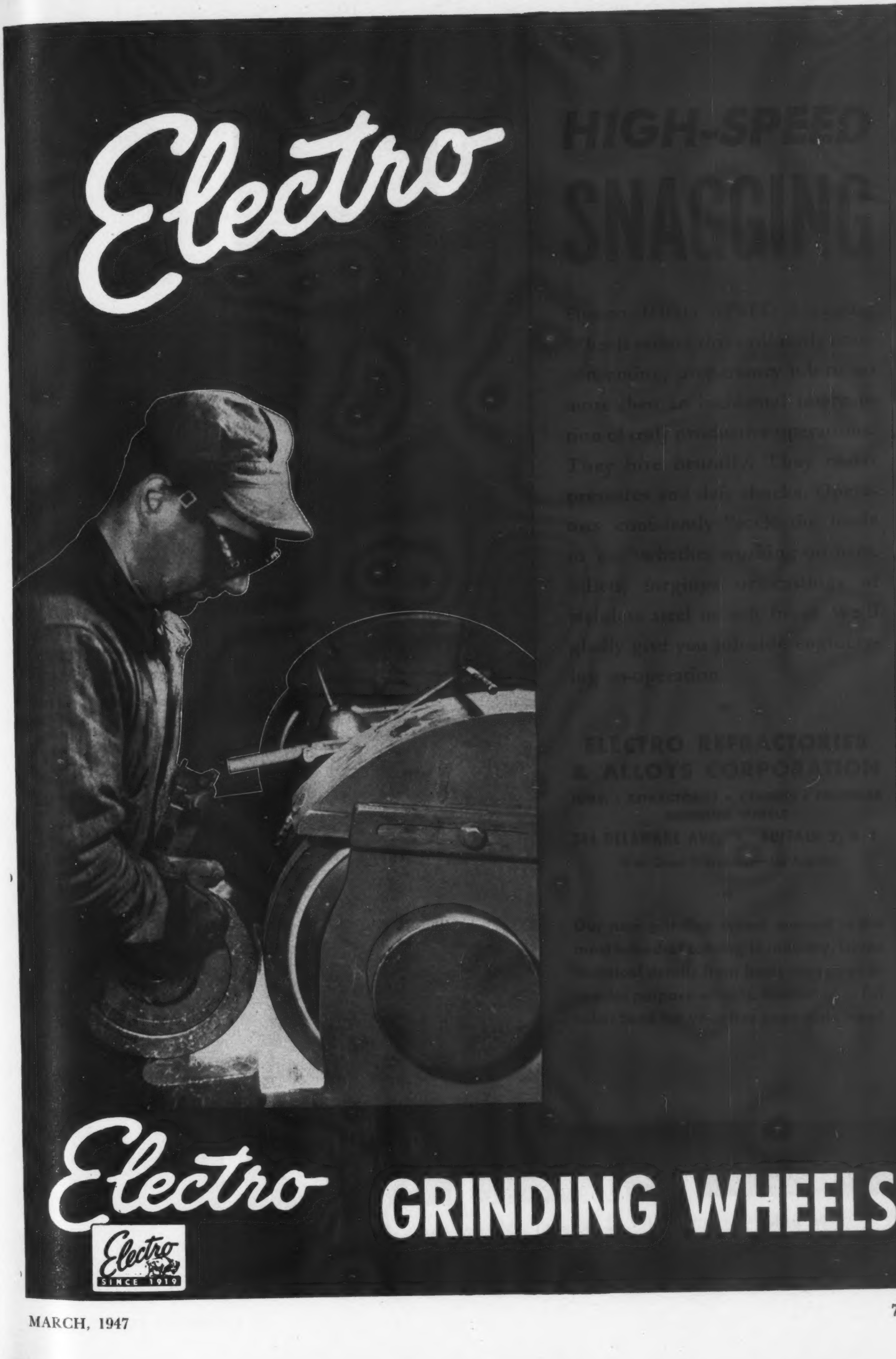
Philadelphia

H. V. Witherington
H. W. Butterworth & Sons Co.
Chapter Director

INTERESTING ASPECTS of the "Gating and Risering of Iron Castings," technical subject of H. H. Kessler, Sorbo-Mat Process Engineers, St. Louis, before Philadelphia A.F.A. chapter, at the Engineers Club, there, February 14, produced a lively general discussion period on modern trends toward standard practices in ferrous casting, over-all risering, and types of skim and dam gates designed to cut scrap losses.

Care should be taken in reducing

(Continued on page 79)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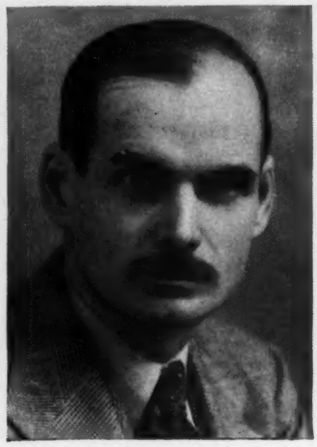

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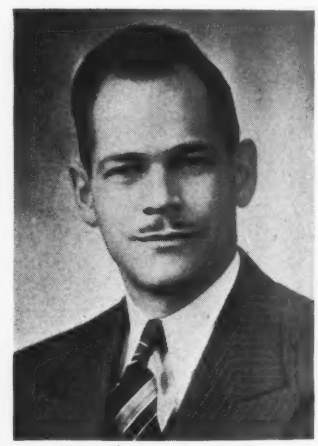

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Crucible Steel Casting Co.
Cleveland
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risers, Mr. Kessler advised, since an increase in scrap should not be accepted in return for higher yield.

F. G. Sefing, International Nickel Co., New York, was chairman.

W. B. George, R. Lavin & Sons, Inc., Chicago, was the speaker of the evening at the technical session of January 10. "Non-Ferrous Casting," was the topic of the speaker, who serves as a member of the Committee on Recommended Practices for Non-Ferrous Castings, A.F.A. Brass and Bronze Division. Pouring of test bars, testing of various non-ferrous metals, and the effect of pouring temperature and chilling rate on the physical properties of test bars and castings, were covered.

Technical chairman for the session was H. L. Smith, Federated Metals Div., American Smelting & Refining Co., Pittsburgh, Pa.

Canton District

N. E. Moore
Wadsworth Testing Laboratory
Chapter Reporter

SELL the foundry industry to prospective workers, show them that the field offers attractive careers, A. J. Tuscany, executive secretary, Foundry Equipment Manufacturers Association, Cleveland advised members and guests of Canton District A.F.A. chapter at the group's January 16 meeting in the Massillon Club, Massillon, Ohio.

Discussing "Future Responsibilities of the Foundry Industry," Mr. Tuscany outlined the requirements for attracting young men to the foundry. The public, he pointed out, must be made conscious of the importance of the castings industry and kept aware of all new developments; good housekeeping must be practiced; the workman's surroundings must be made more pleasant, the foundry kept abreast of the times.

Educational institutions, the speaker observed, should be equipped and organized for instruction in the foundry trade. Adequate training will give the student the background to advance.

Prior to the technical session, A.F.A. National Vice-President Max Kuniansky, Lynchburg Foundry Co., Lynchburg, Va., and A.F.A. Technical Director S. C. Massari, addressed the meeting briefly. The National Officers had met, earlier in the day, with chapter officers and management representatives of foundries of the area, when the contributions of A.F.A. activities to the advancement of the industry were discussed for top management.

No. Illinois and So. Wisconsin

H. J. Bauman
Ebaloy, Inc.
Chapter Secretary

FOUR ASPECTS of cupola melting were stressed by R. A. Clark, Electro Metallurgical Co., Chicago, speaker of the evening at the January 14 meeting of Northern Illinois and Southern Wisconsin A.F.A. chapter in the Faust Hotel, Rockford, Ill.

In outlining the "Principles of Cupola Operation," Mr. Clark went into detail regarding supervision of melting; charging methods; regulation of the air blast, and proper proportions in the coke and metal mixture of the charge.

Western New York

L. C. Thellemann
Kencroft Malleable Co.
Chairman, Publicity Committee

SIMULTANEOUS TECHNICAL SESSIONS were a feature of the February 7 meeting of Western New York A.F.A. chapter in the Hotel Touraine, Buffalo.

T. E. Barlow, Battelle Memorial Institute, Columbus, spoke on "Cupola Practice" before the gray iron foundrymen. Factors which must be taken into consideration to obtain uniform conditions in daily operation of the cupola were outlined by the speaker. E. J. Burke, Hanna Furnace Corp., Buffalo, was chairman of the gray iron castings session of the meeting.

Steel and non-ferrous foundrymen heard Michael Bock, II, Unexcelled Chemical Corp., Cambridge, Mass., discuss "New Methods of Gating and Risering." Shrinkage in castings was cited by the speaker as one of the most troublesome of all foundry problems, and one which has spurred recent developments in gating and risering techniques. M. J. O'Brien, Symington-Gould Corp., Depew, N.Y., served as group chairman.

Chapter Chairman H. C. Winte, Worthington Pump & Machinery Corp., Buffalo, presided at the business portion of the meeting.

Central Indiana

J. W. Giddens
International Harvester Co.
Chapter Reporter

THE MODERN FOUNDRY is in a transition period, and there exists a lack of young men coming into the industry, Central Indiana A.F.A. chapter members and their friends were told at the January 6 meeting in the Hotel Antlers, Indianapolis, by the speaker of the evening, A. J. Tuscany, executive secretary, Foundry Equipment Manufacturers Association, Cleveland. Title of his talk was "Future Responsibilities of the Foundry."

For adequate training of future foundrymen, Mr. Tuscany said that equipment is needed in foundry schools. Such equipment, he commented, may be obtained by the schools from the government out of war surplus property.

Concluding, the speaker advocated that foundries become more alert in publicizing their industry, the quality of its products, and the career opportunities it offers.

R. S. Davis, National Malleable & Steel Castings Co., Indianapolis, served as technical chairman. G. E. Clark, Cummins Engine Co., Columbus, Ind., and H. J. Druecker, Indiana Products Co., Kokomo, Ind., were elected Directors of the chapter, for terms expiring, respectively, 1949 and 1948. Mr. Clark replaces W. W. McClenon, formerly with American Foundry Co., Indianapolis, who is no longer associated with the foundry industry; and Mr. Druecker, Fred Carl, Delco-Remy Div., General Motors Corp., who has been transferred to Lockport, N.Y.

Foundry management personnel should take the lead in the civil affairs of the community, M. F. Stigers, associate professor of trade and industrial education, Purdue University, Lafayette, Ind., told the chapter members at the February 3 meeting in the Hotel Antlers.

Speaking on "The Industrial Foreman in Postwar America," Prof. Stigers pointed out that credit is reflected to an industry through its leaders' community activities.

Industrial foremen should be considered practicing psychologists, the speaker said, and they must know testing procedures, tests and

(Continued on page 81)

their applications; how to "get along" with men under them and supervisors above them; how to instruct subordinates in safety and good housekeeping practices and how to win cooperation of workers in observing such practices.

Technical chairman for the evening was G. C. Dickey, Harrison Steel Castings Co., Attica, Ind.

Metropolitan

C. J. Law
Worthington Pump & Machinery Corp.
Chapter Director

"CORE BLOWING" was the topic of the technical session at the meeting of Metropolitan A.F.A. chapter, February 3 in the Essex House, Newark, N.J., with Zigmond Madacey, Caterpillar Tractor Co., Peoria, Ill., as speaker of the evening.

To produce cores by blowing, Mr. Madacey told the 350 members and guests in attendance, the foundry must control the sand and the size and location of blowholes and vents. Moisture content in sand, he advised, should range from 1.8 to 2.5 per cent, depending on the grain size, and should be controlled to within 0.2 per cent of the amount desired. Too wet a sand does not blow; too dry a sand causes excessive wear of core boxes. Green sand strength of approximately 1.5 pounds per square inch, and an oil-sand ration of 1 to 50, by volume, were recommended.

Location and size of vents and blowholes, Mr. Madacey said, are governed by the size and shape of the core box, and foundrymen should obtain information on the subject, rather than experiment haphazardly. It must be kept in mind that air which enters the box must escape; therefore, the total area of the vents must be equal to, or greater than that of the blowholes. Air pressure used in blowing cores ranges from 80 to 125 pounds per square inch; lower pressures cause less core box wear, but require the use of larger holes.

Chapter Chairman H. L. Ullrich, Sacks-Barlow Foundries, Inc., Newark, presided during the business portion of the meeting; and turned the technical session over to the technical chairman, W. F. Rose, Smith Oil Co., Ramsey, N.J.

At the January 6 meeting in the Essex House, chapter members heard F. G. Sefing, International Nickel Co., New York, on "Production of Sound Castings."

The soundness of commercial castings has increased greatly in the past few years, he declared, due to better understanding by foundrymen of the fundamental principles involved. He predicted even greater improvement in the future. Progress in the production of sound castings, he said, is dependent upon the ability of the industry to secure men who can think on the job.

Two basic principles, Mr. Sefing told the foundrymen, govern the successful production of all cast metals: controlled directional solidification, involving the arrangement of gates and risers so that liquid metal is fed to all hot areas until shrinkage is completed; and maintenance of cleanliness of the metal, which requires that metal be clean as it leaves the ladle and remain clean until it settles in the mold. The latter may be facilitated through the use of skimmer screens.

R. H. Schaefer, American Brake Shoe Co., Mahwah, N.J., served as chairman for the technical session.

Northwestern Pennsylvania

J. E. Gill
Lake Shore Pattern Works
Chapter Director

"GATES AND RISERS for Sound Castings," proved an unusually interesting topic and provided the foundrymen of Northwestern Pennsylvania A.F.A. chapter with material for an extended and valuable general discussion period, following the technical session of the January 27 meeting in the Moose Club, Erie.

H. C. Winte, Worthington Pump & Machinery Corp., Buffalo, N.Y., and Chairman, Western New York A.F.A. chapter, was the speaker of the evening. F. J. Eisert, Urick Foundry Co., Erie, led the discussion as technical chairman; and Chapter Chairman E. M. Strick, Erie Malleable Iron Co., of that city, presided at the dinner.

The value of careful melting and pouring practices, as well as of proper molding and coring procedures, was stressed in Mr. Winte's presentation. He elaborated upon the various types of gating which may be used to produce sound castings. The Washburn core is highly effective when used in conjunction with exothermic material in the head, Mr. Winte said. Of particular interest to the foundrymen was a formula, presented by the speaker, for the use of shrink bobs with either round or square openings into the casting to be fed.

Saginaw Valley

J. J. Clark
General Motors Corp.
Chapter Director

FUNDAMENTALS of foundry accounting, as described by R. G. Leckie, Chevrolet Grey Iron Foundry Div., General Motors

FUTURE CONVENTIONS AND EXHIBITS

American Society of Lubrication Engineers, Annual Meeting, Pittsburgh, Pa.—March 17-19.

American Society of Tool Engineers, Annual Meeting, Rice Hotel, Houston, Texas—March 19-22.

American Welding Society, Pacific Coast District Meeting, Oakland, Calif.—March 22.

Western Metals Congress and Exposition, American Society for Metals, Oakland, Calif.—March 22-27.

American Chemical Society, 111th National Meeting, Atlantic City, N.J.—April 14-18.

American Institute of Mining and Metallurgical Engineers, National Open Hearth and Coke Oven, Blast Furnace and Raw Materials committees, 30th Annual Conference, Netherland Plaza, Cincinnati—April 21-23.

AMERICAN FOUNDRYMEN'S ASSOCIATION, 51st Annual Meeting, Detroit—April 28-May 1.

Industrial Packaging and Materials Handling Exposition. Industrial Packaging Engineers Association of America, Chicago—April 29-May 1.

Society for Experimental Stress Analysis, Stevens Hotel, Chicago—May 15-17.

American Society of Mechanical Engineers, Oil and Gas Power, 19th National Conference, Cleveland—May 21-24.

American Society of Mechanical Engineers, Aviation Meeting, Los Angeles—May 26-29.

REGIONAL CONFERENCE

Seventh New England Foundry Conference, New England Foundrymen's Association, Massachusetts Institute of Technology, Cambridge—March 28-29.

Corp., Saginaw, Mich., and technical speaker at the meeting of Saginaw Valley A.F.A. chapter, February 6 in Fischer's Hotel, Frankenmuth, Mich., produced an extended general discussion among the foundrymen. Accounting methods for foundries, analysis of costs, and the relationship between the results of such analysis and improved methods, were highlights of the session.

Northern California

C. R. Marshall
Chamberlain Co.
Chapter Co-Secretary

THE TECHNICAL SESSION of the meeting of Northern California A.F.A. chapter, January 10 at the Hotel Alameda, Alameda, Calif., featured discussions on abrasive cleaning, grinding wheels, and the abrasive belt method of polishing and grinding. The speakers were Davis Taylor, American Wheelabrator & Equipment Corp., San Francisco; J. M. Snyder, Jos. Musto Sons-Keenan Co., of the same city, and Roger Dunn, Minnesota Mining & Manufacturing Co.

The development of abrasive blasting, from the earliest patents, issued in London in 1870, to the modern cleaning machines designed during the war, was covered in Mr. Taylor's address. He climaxed his presentation with a series of interesting slides, depicting modern abrasive cleaning installations.

Following a brief history of the modern grinding wheel, Mr. Snyder described applications of the various types of wheels. In concluding, he stressed the importance of education of operators in the interest of obtaining maximum results.

Belt grinding was demonstrated by Mr. Dunn and his assistants on two machines set up for the purpose. The speaker outlined principles and techniques of the method.

During the business portion of the meeting, with Chapter President Richard Vosbrink, Berkeley Pattern Works, Berkeley, Calif., presiding, the members heard the reports of committee chairmen: R. C. Noah, San Francisco Iron Foundry, of that city, apprentice committee; Fred Mainzer, Pacific Brass Foundry of San Francisco, finance committee; H. A. Bossi, H. C. Macaulay Foundry Co., Berkeley, reporting for the apprentice training group in the absence of its chairman, Chapter Vice-President A. M. Ondreyco, Vulcan Foundry Co., Oakland, Calif.

Progress of the chapter's activities in sponsorship of the Boy Scout Foundry Practice Merit Badge display for the Oakland Scout-O-Rama was reported by Chapter Co-Secretary C. R. Marshall, Chamberlain Co., Oakland. Chapter Secretary J. F. Aicher, Vulcan Foundry Co., presented the regrets of AMERICAN FOUNDRYMAN for its erroneous listing in the November issue of the company affiliation of four new members as, "Gladding McBean & Co., *Los Angeles,*" rather than, *San Francisco.*

Connecticut Non-Ferrous

L. G. Tarantino
Niagara Falls Smelting & Refining Corp.
Association Secretary

PERFORMANCE AND DESIGN DATA on high frequency induction furnaces were featured in the technical paper on "Electric Furnace Melting" presented by G. F. Applegate, Ajax Electrothermic Corp., Trenton, N.J., at the regular meeting of the Connecticut Non-Ferrous Foundrymen's Association, December 13 in the Hotel Taft, New Haven, Conn.

"An induction furnace is a transformer: the primary is the furnace coil; the secondary, the charge," Mr. Applegate explained in his description of high frequency units. "The primary is a helical coil of copper tubing, insulated between turns, through which water is passed to cool the copper.

"When high frequency current is applied to the terminals of the helix, all space within the coil is subjected to a rapidly alternating electro-magnetic field; any electrical conductor there (in this case the furnace charge) has induced in it currents which cause rapid heating up to and beyond the melting point.

The speaker went on to describe the types of furnaces available, the "lift coil," in which the furnace box and coil are so arranged that they may be lifted away from the crucible, and the "tilting," in which the crucible is a fixed part of the furnace and pouring is accomplished by rotating the entire unit. Both are effective, Mr. Applegate observed, and each has its own field.

An outstanding advantage of the units described, the speaker said, is a stirring action produced within the metal by the electro-magnetic forces. This action is said to be so rapid and thorough that charges can often be poured within seconds after the last alloy element has been melted down. Alloys in which there is a tendency toward segregation are effectively stirred, Mr. Applegate reported, adding that the rapid melting also permits little chance for oxidation.

In response to questions during the general discussion period, the speaker said that, due to the stirring action, temperature of the melt cannot reach the "superheated" range so long as any part of the charge is not above the melting point; no gas pick-up due to turbulence or stirring action had ever been reported for the type of units discussed; and life of the crucible used in such equipment was reported equal to crucible life in other methods, although depending upon abrasion during charging or handling in the case of the "lift coil" furnace.

Birmingham District

J. P. McClendon
Stockham Pipe Fittings Co.
Chairman, Publicity Committee

PRACTICAL RECOMMENDATIONS on "How to Select a Bond Clay" were given to foundrymen of the Birmingham, Ala., area January 17 at the Tutwiler Hotel, there, by N. J. Dunbeck, Eastern Clay Products, Inc., Jackson, Ohio, addressing the regular meeting of Birmingham District A.F.A. chapter.

The speaker drew from a background of some 20 years in foundry sand work for his observations on bonding, and added further data on that subject and on synthetic sands, their nature and advantages, during the animated discussion period that followed his presentation.

Prior to the technical session, some 100 members and guests were on hand for the dinner honoring Mr. Dunbeck, who serves as Chairman, Central Ohio A.F.A. chapter, and has presented many technical papers before Association groups.

At the business meeting, chapter directors announced the formation of a chapter educational committee. Named to serve on this committee

(Concluded on page 91)

Wisconsin

(Continued from page 63)

At the annual banquet Dr. A. E. Kahn, head of the department of economics, Ripon College, Ripon, Wis., discussed "The Economic Basis for Lasting Peace." National President S. V. Wood, Minneapolis Electric Steel Castings Co., Minneapolis, spoke briefly in support of programs to interest American youth in the foundry industry.

Friday morning's steel session had two subjects covering shot blasting and grinding wheel testing. James T. Gaw, Battelle Memorial Institute, Columbus, Ohio, presented "Shot and Grit for Metal Blastings." Methods for study of physical and mechanical properties in the industrial application of the metal blasting media were discussed. The selection of blast cleaning media as to size, form, hardness and rate of breakdown was considered from the standpoint of work to be cleaned, the production desired, and the type of finish sought.

Grinding Wheel Tests

M. J. Kolthoff, Steward Instrument Co., Chicago, gave an instructive paper on "Grinding Wheel Testing Methods." He enumerated the reasons for conducting tests, described present methods of testing, outlined grinding wheel costs and presented a worthwhile demonstration of a productive time and productive energy analyzer.

Charles W. Briggs, technical and research director, Steel Founders Society of America, of Cleveland, gave steel foundrymen an answer to the question "What Do You Know about New Materials and Methods for the Production of Steel Castings?"

Examples of annealing and stress relief of commercial castings were given in a paper read by James Vanick, International Nickel Co., New York. Mr. Vanick listed seven ways in which residual stress could be attacked: (1) increasing mold collapsibility; (2) increasing core collapsibility; (3) using pattern draft to provide greater freedom during contraction; (4) eliminating temperature gradients by attention to

distribution of liquid metal entering the mold; (5) chilling hot spots; (6) reinforcing weak zones with ribs, tie-bars, webs, etc. and (7) adjusting chemistry of the metal. Detailed discussion of each procedure followed.

Discusses Cupola Control

Second gray iron speaker was Tom Barlow, Battelle Memorial Institute, and his subject was "Cupola Control and Melting Practice." Brought under discussion were blowers, air control, piping, air distribution, contour patching, tuyeres, wind box leaks, coke bed, coke ratio and control instruments.

Before the malleable sessions L. D. Pridmore and W. D. McMillan spoke on "Stack Molding in the Malleable Foundry" and "Some Factors Affecting Annealing," respectively. Mr. Pridmore, associated with International Molding Machine Co., Chicago, stressed the type of sand used, difficulties encountered with cores, pouring practices to follow and procedures involved in shakeout.

Mr. McMillan, International Harvester Co., Chicago, reviewed the effect of the five principal elements and these were grouped as the tangible factors which lend themselves to determination and hence to control by chemical methods of analysis.

George Anselman, Goebig Mineral Supply Co., Chicago, prepared a paper on "Non-Ferrous Foundry Sand" for the initial non-ferrous session. He compared the two general types of sand used in the foundry today; first, the high pan (fine) low permeability sand, and, second, the low pan (coarse) high permeability. The uses and misuses of the material were discussed.

Chart For Cost Control

Next speaker to address the non-ferrous group was J. W. Wolfe, executive secretary, Non-Ferrous Founders' Society, Chicago, with "Budgeting Foundry Costs" as his subject. A simple "breakeven" chart was set up and the various factors governing its use were explained. These factors included what should be normal operation in sales volume or the sales volume determined by customer future needs.

(Continued on page 89)


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Thus we can make any adjustment in the composition of the metal, before it is poured, that may be necessary to bring it in line with your specifications. You will find you can count on Aluminum Refiners Ingot to be exactly as ordered by you.
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MANUFACTURERS OF ALL TYPES AND SHAPES OF CASTING AND DEOXIDIZING ALLOYS

Wisconsin

(Continued from page 87)

By reference to the chart, it is possible to forecast the point where fixed charges have been earned and profits begin; also to determine ultimate percentage of profits to be obtained in the operation.

At the pattern meeting A. K. Laukel, Electro-Chemical Pattern & Mfg. Co., Detroit, gave a talk on "Production of Copper Patterns by Electro Forming." A brief description of his company's molding technique was given, along with the advantages which apply to the principles of electro-forming.

A. F. Pfeiffer, Allis-Chalmers Mfg. Co., Milwaukee, dealt with "New Pattern Methods." He exhibited slides showing different types of pattern equipment with molds and cores and castings. The construction of pattern equipment for cement molding was discussed; also the use of plastics.

Dr. A. O. Smith, Kearney & Tucker Co., Milwaukee, presented a motion picture film to illustrate key points in his lecture on "Recent Research in Machinability."

C. O. Burgess, Union Carbide & Carbon Research Laboratory, Inc., Niagara Falls, N.Y., discussed "Structure and Properties of Cast Iron as Affected by Alloying and Inoculation." Keynote of the talk was the importance of all foundrymen being able to produce uniform and predictable properties and structure in whatever grade of cast iron is specified.

The closing session was a general meeting at which Frank Steinbach, editor, *The Foundry*, Cleveland, spoke on the subject, "Recent Progress in the Foundry Industry."

Beg Your Pardon

AMERICAN FOUNDRYMAN regrets that the name of Dr. R. F. Thomson, International Nickel Co., Detroit, was given as "Dr. R. F. Thomas," in the article concerning the research project of the A.F.A. Aluminum and Magnesium Division, on page 80 of the February issue. Dr. Thomson is Chairman, Research Committee, of the Aluminum and Magnesium Division.

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further experience in the foundries of Western Electric Co., Chicago; Risdon Iron Works, San Francisco, and Davis Iron Works, Denver.

While employed at the University of Michigan in 1909-10 his skill as a foundryman attracted attention. And it was at that university that he first recognized the importance of engineering school training in foundry practice.

Securing an appointment as an instructor at the University of Nebraska, he taught in the forge and foundries school there until 1914. Later he held similar positions at Michigan State College, the University of Illinois, and the Army Vocational School at Camp Grant, Ill. He returned to the University of Michigan in 1921.

Mr. Grennan's first technical paper appeared in the A.F.A. TRANSACTIONS of 1910. This was the forerunner of the many reports he was to submit. In 1923 his paper on "Training Foundry Workers" was presented at the Cleveland convention. He is numbered among the contributors to "Modern Core Practices and Theories" and the "Cupola Handbook."

SHELDON V. WOOD, who has given A.F.A. a year of inspiring leadership in a trying period of industrial reconversion, will receive Honorary Membership "as the retiring President of the Association."

During his administration, membership passed the 9000 mark to set a new record high. Under his leadership, the technical, educational and other service groups of A.F.A. widened and intensified their activities; and increasing interest in A.F.A. as a cooperative organization was evidenced by growth of the chapter movement.

Mr. Wood, who started his business career as a mining engineer, is president and general manager of Minneapolis Electric Steel Castings Co., Minneapolis. An eager willingness to participate in industry-level, self-help programs and a deep interest in educational work has charac-

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Chapters

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were Dr. J. T. MacKenzie, American Cast Iron Pipe Co. chairman; C. P. Caldwell, Caldwell Foundry & Machine Co., and E. A. Thomas, Thomas Foundries, Inc., all of Birmingham. The committee will outline foundry training courses to provide ample opportunity for actual foundry practice and to demonstrate to students and the public that "The Foundry is a Good Place to Work." Colleges and universities in and near Birmingham, and city and county boards of education, have been contacted.

Central Ohio

D. E. Krause
Battelle Memorial Institute
Chapter Reporter

COMMON ERRORS in foundry practice, which lead to the production of an inferior grade of gray iron, were pointed out by R. G. McElwee, manager, foundry division, Vanadium Corp. of America, Detroit, and Chairman, Cupola Research Committee, A.F.A. Gray Iron Division, who spoke on "Control of Cast Iron Production" before the gray iron section of the technical session at the meeting of Central Ohio A.F.A. chapter, January 27 in Columbus.

C. L. Frear, senior materials engineer, Bureau of Ships, U. S. Navy Department, Washington, D.C., was the speaker on "Non-Destructive Testing of Castings" before the steel section. Examination of castings by x-ray and gamma-ray were explained by Mr. Frear, who also described briefly other non-destructive procedures, such as the magnetic particles test.

Effects of variations in technique were illustrated by Mr. Frear with a series of radiographs of standard step blocks. Other radiographs were exhibited to illustrate the appearance of common casting defects. Examination of sections more than 1¼ inches thick were considered, and the speaker noted that, in the case of x-ray inspection, higher voltages were generally used, to decrease exposure time.

Mr. McElwee, discussing the practice of taking a sample of gray iron for analysis at a given time each day and considering the analysis as representative of the day's heat, pointed out that variations in the composition of the iron during one day may be greater than that shown in analysis of samples taken at the same time each day over the period of a month. He expressed the opinion that it is better control practice to make analyses one day of the month—but at frequent intervals throughout the heat.

The speaker displayed graphs on which curves were plotted to demonstrate the effect of variations in carbon and silicon content, expressed as carbon equivalent, on the tensile strength of the iron. In the discussion which followed, the beneficial effects of the addition of inoculants were indicated.

Some of the questions raised by members served to bring out the complexity of gray iron metallurgy, especially in engineering irons.

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terized his career. His association with the foundry industry dates from 1913 when he joined Electric Steel as manager.

A native of Iowa, Mr. Wood was graduated from the University of Minnesota in 1904. His previous connections include Butler Bros., Hibbing, Minn.; Great Northern Railway, St. Paul, and Olds Gas Engine Co., Lansing, Mich.

He was active in the work of the Twin City Foundrymen's Association and assisted in formation of its successor, the Twin City chapter of A.F.A., of which he is a past chairman and former director.

Director of A.F.A. in 1942-45, Mr. Wood served as vice president in 1945-46 and was elected forty-fifth president at the Association's Golden Jubilee convention.

Q. & A. on Refractories

A QUESTION and answer period will be a feature of the Refractories Committee program at the A.F.A. Convention in Detroit. The Refractories meeting is scheduled for 4:00 p.m., April 29. Anyone having a question relative to the use of refractories in any type of foundry work may present it at this meeting or the question may be submitted in advance to the Chairman, R. H. Stone, Vesuvius Crucible Co., Pittsburgh, Pa.

Sand Division Committee

Subcommittee on Core Strengths, Committee on Core Tests, H. W. Dietert, Chairman; O. J. Myers, Werner G. Smith Co., Cleveland, Vice-Chairman; R. D. Walters, Werner G. Smith Co., Secretary; A. E. DeClercq, Lauhoff Grain Co., Detroit; G. R. Gardner, Aluminum Co. of America, Cleveland; J. A. Mescher, Unitcast Corp., Toledo, Ohio; R. E. Morey.

Knight in New Quarters

Lester B. Knight & Associates, Chicago, recently moved to larger quarters at 600 W. Jackson Blvd. **L. B. Knight,** president, announces that the staff has been expanded steadily and now comprises 35 members handling foundry problems.